Doc. no.LEC-OM03901A

Operation Manual

PRODUCT NAME

Programless controller

Step motor (servo 24 VDC)

MODEL/ Series

LECP1 Series

SMC Corporation

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LECP1 Series / Controller Safety Instructions

These safety instructions are intended to prevent hazardous situations and/or equipment damage.
These instructions indicate the level of potential hazard with the labels of “Caution,” “Warning” or “Danger.” They are all important notes for safety and must be followed in addition to International Standards (ISO/IEC), Japan Industrial Standards (JIS)*1) and other safety regulations*2).

*1) ISO 4414: Pneumatic fluid power -- General rules relating to systems
ISO 4413: Hydraulic fluid power -- General rules relating to systems
IEC 60204-1: Safety of machinery -- Electrical equipment of machines (Part 1: General requirements)
ISO 10218-1992: Manipulating industrial robots -- Safety
JIS B 8370: General rules for pneumatic equipment.
JIS B 8361: General rules for hydraulic equipment.
JIS B 9960-1: Safety of machinery – Electrical equipment for machines. (Part 1: General requirements)
JIS B 8433-1993: Manipulating industrial robots - Safety. etc.

*2) Labor Safety and Sanitation Law, etc.

Caution	Operator error could result in injury or equipment damage.
Warning	Operator error could result in serious injury or loss of life.
Danger	In extreme conditions, there is a possibility of serious injury or loss of life.

⚠Warning

1. The compatibility of the product is the responsibility of the person who designs the equipment or decides its specifications.

Since the product specified here is used under various operating conditions, its compatibility with specific equipment must be decided by the person who designs the equipment or decides its specifications based on necessary analysis and test results.

The expected performance and safety assurance of the equipment will be the responsibility of the person who has determined its compatibility with the product.

This person should also continuously review all specifications of the product referring to its latest catalog information, with a view to giving due consideration to any possibility of equipment failure when configuring the equipment.

2. Only personnel with appropriate training should operate machinery and equipment.

The product specified here may become unsafe if handled incorrectly.

The assembly, operation and maintenance of machines or equipment including our products must be performed by an operator who is appropriately trained and experienced.

3. Do not service or attempt to remove product and machinery/equipment until safety is confirmed.

The inspection and maintenance of machinery/equipment should only be performed after measures to prevent falling or runaway of the driven objects have been confirmed.

When the product is to be removed, confirm that the safety measures as mentioned above are implemented and the power from any appropriate source is cut, and read and understand the specific product precautions of all relevant products carefully.

Before machinery/equipment is restarted, take measures to prevent unexpected operation and malfunction.

4. Contact SMC beforehand and take special consideration of safety measures if the product is to be used in any of the following conditions.

1) Conditions and environments outside of the given specifications, or use outdoors or in a place exposed to direct sunlight.
2) Installation on equipment in conjunction with atomic energy, railways, air navigation, space, shipping, vehicles, military, medical treatment, combustion and recreation, or equipment in contact with food and beverages, emergency stop circuits, clutch and brake circuits in press applications, safety equipment or other applications unsuitable for the standard specifications described in the product catalog.
3) An application which could have negative effects on people, property, or animals requiring special safety analysis.
4) Use in an interlock circuit, which requires the provision of double interlock for possible failure by using a mechanical protective function, and periodical checks to confirm proper operation.

LECP1 Series / Controller Safety Instructions

⚠ Caution

The product is provided for use in manufacturing industries.
The product herein described is basically provided for peaceful use in manufacturing industries.
If considering using the product in other industries, consult SMC beforehand and exchange specifications or a contract if necessary.
If anything is unclear, contact your nearest sales branch.

Limited warranty and Disclaimer/Compliance Requirements

The product used is subject to the following “Limited warranty and Disclaimer” and “Compliance Requirements”.
Read and accept them before using the product.

Limited warranty and Disclaimer

The warranty period of the product is 1 year in service or 1.5 years after the product is delivered.*3)
Also, the product may have specified durability, running distance or replacement parts. Please consult your nearest sales branch.

For any failure or damage reported within the warranty period which is clearly our responsibility, a replacement product or necessary parts will be provided.
This limited warranty applies only to our product independently, and not to any other damage incurred due to the failure of the product.

Prior to using SMC products, please read and understand the warranty terms and disclaimers noted in the specified catalog for the particular products.

***3) Vacuum pads are excluded from this 1 year warranty.**
A vacuum pad is a consumable part, so it is warranted for a year after it is delivered.
Also, even within the warranty period, the wear of a product due to the use of the vacuum pad or failure due to the deterioration of rubber material are not covered by the limited warranty.

Compliance Requirements

When the product is exported, strictly follow the laws required by the Ministry of Economy, Trade and Industry (Foreign Exchange and Foreign Trade Control Law).

2. Outlines of Product

2.1 Features

Features of the controller.

- Actuator control

  Servo control enables the positioning and the operation with a specified thrust of the actuator.

- Operation and settings are available with the controller.

  Settings can be altered and operation can be fun from the controller. Adjustments of the position, speed, acceleration and test runs are available without the teaching box, PC, and PLC.

- Operation with specified thrust

  The holding force and pushing force of the actuator can be controlled in three steps.

- Separated power supply input

  Power supply input is separated into the motor power supply and control power supply. Even if the power supply for the motor is turned off, the information of the encoder position is not lost while the control power supply is on, and parallel I/O control is available.

- Automatic sequence function of the returning to origin position

  Returning to origin position is available through I/O signal combination.

- Alarm detection

  Abnormal conditions are self-detected. Alarms are displayed by LED on the controller and abnormal conditions are output to the outside by the parallel I/O terminal.

- 14 points positioning / pushing is available

  Through the combination of parallel I/O inputs, 14 points (position number 1 to 14(E)) of positioning / pushing are available. The speed and acceleration of the positioning can be set by the switch for each operating direction.

- Data input method

  Parameter settings, test runs, and alarm resets can be performed by the controller.

⚠ Caution
When the device is set up or failure occurs, please refer to the operation manual of the actuator as well as this operation manual. * Keep this operation manual accessible so it can be referred to when necessary.

2.2 How to Order

How to order is shown below.

Controller

L E C P 1 N □ − □

Controller

Applicable motor

P	Step motor（servo DC24V）

Step data

1	14 points (Programless)

Parallel input / output type

N	NPN type
P	PNP type

Actuator Model

(Enter from the actuator model "LE" to ”stroke”)
Ex: LEHZ10LK2-4AF-R11N1
Enter "LEHZ10LK2-4"

I/O cable length

Nil	No cable
1	1.5m
3	3m
5	5m

* Power cable length is 1.5m only

Actuator ＋ Controller

L E H Z 1 0 L K 2 − 4 A F − R 1 1 N 1

Actuator type

Fill in How to Order referring to How to Order of the catalog of Actuators.
Please refer to the table below for the applicable actuators.
Ex. ：LEHZ10LK2-4AF-R11N1

Applicable actuators
Electric gripper LEH Series
Electric slide table LES Series
Electric actuator / Rod type LEY Series
Electric actuator / Slider type LEF Series
Electric actuator / Rotary type LER Series

I/O cable length*

Nil	No cable
1	1.5m
3	3m
5	5m

Controller

Nil	No controller*
1N	With programless controller (NPN)
1P	With programless controller（PNP）

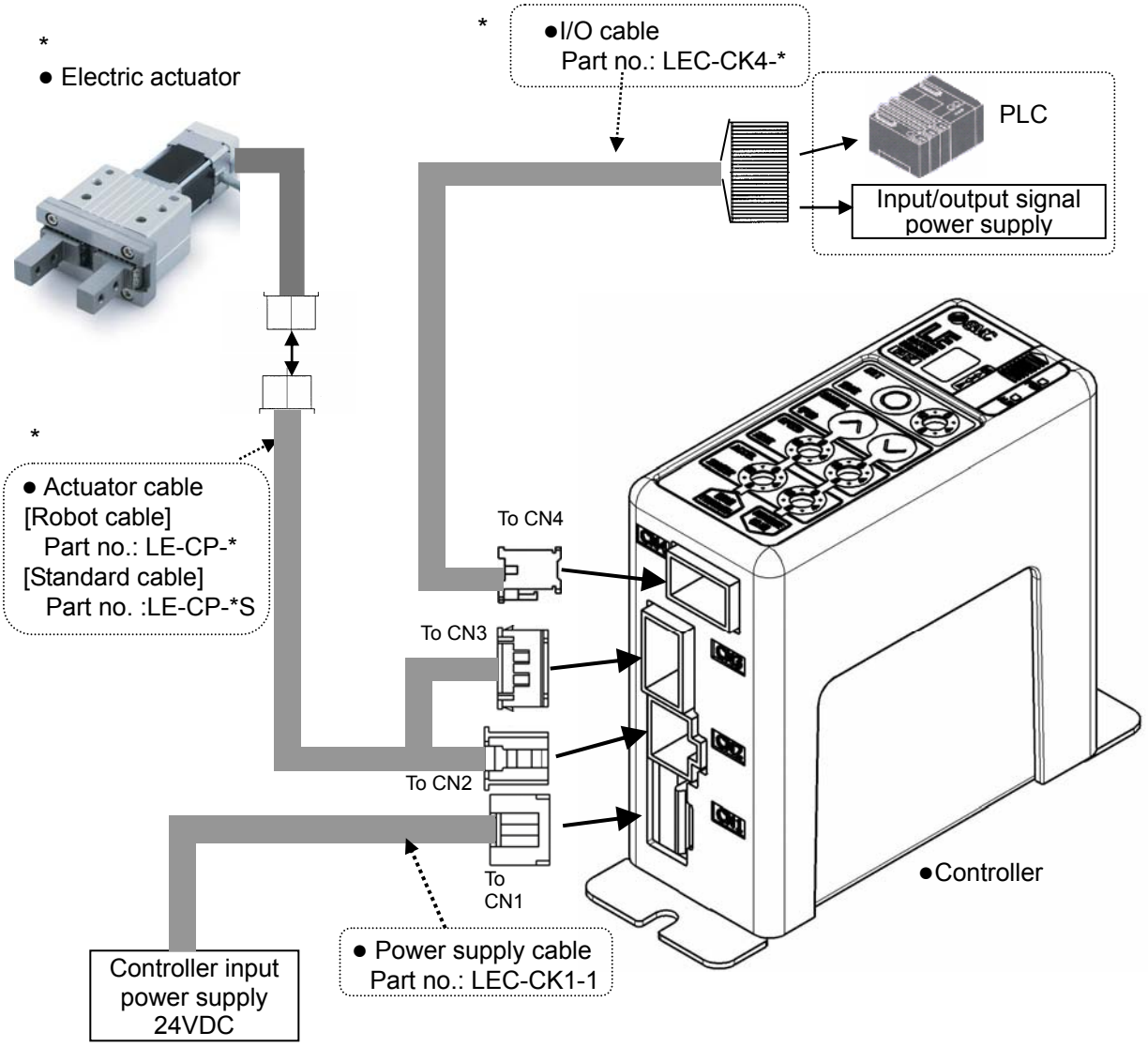
* If the actuator is ordered without the controller, the I/O cable type is not available.
LECP6 series I/O cables cannot be used due to different specification.

⚠ Caution

Single controllers are also shipped after setting the actuator specification parameters.
Confirm the combination of the controller and the actuator is correct.

2.3 Structure of the product

Structure of the controller.



* These items are included if you ordered using the part number for an actuator set.

⚠ Warning

Refer to **4. External connection (P.15)** for wiring.
Refer to **13. Wiring of cables/Common precautions (P.65)** when handling the wiring and cables.

2.4 Procedure （How to start the actuator)

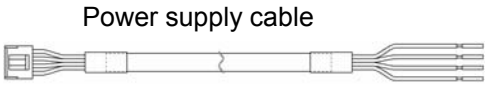
Install, wire, set and operate the controller referring to the procedure below when the product is used for the first time.

(1) Checking the contents of the package

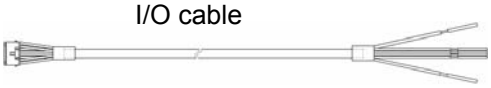
After unpacking everything, check the description on the label to identify the controller and the number of accessories.

Part's name	Quantity
Controller （LECP1□□-□）	1 pcs.
Power supply cable (LEC-CK1-1)	1 pcs.
I/O cable *(LEC-CK4-□)	1 pcs.
Actuator *	1 pcs.
Actuator cable * Robot cable: LE-CP-□ or Standard cable: LE-CP-□S	1 pcs.

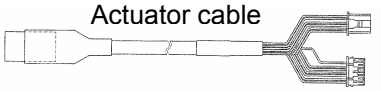
Controller



Power supply cable



I/O cable



Actuator cable

* These items are included if you ordered using the part number for an actuator set.

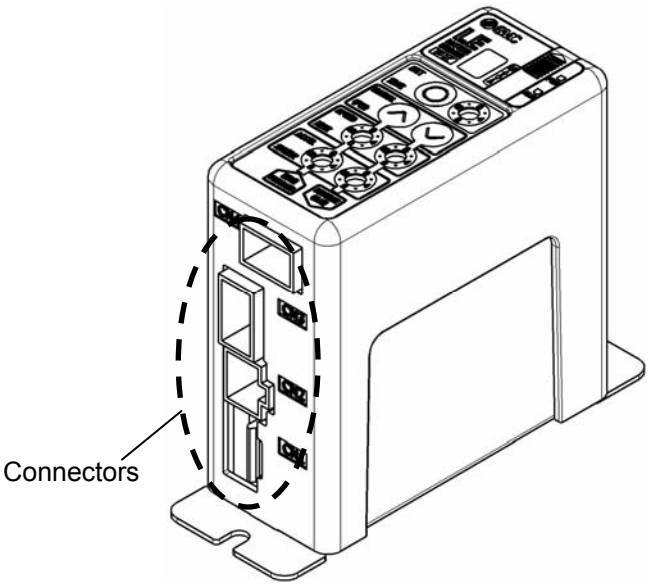
If parts are missing or damaged, please contact our distributor.

(2) Mounting the Controller

Refer to **<u>3.4 Mounting (P. 13)</u>** to mount the controller.

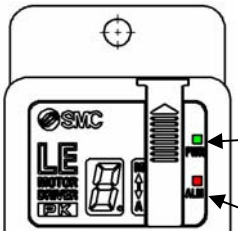
(3) Controller Wiring / Connection

Connect cables to the controller connectors (CN1 to CN4). Refer to **<u>4. External connection (P.15)</u>** for the wiring of the cables.



(4) Power supply ON　　Alarm check

Supply power 24V DC.



Controller

Description	LED turns on	Condition
PWR	Green LED is on	Servo is on
	Green LED is flashing	Servo is turned off
ALARM	Red	Alarm is generated

If the conditions are normal, the LED[PWR] at the front of the controller switches from a flashing to a solid light. The servo is turned on if the conditions are normal. If the LED[ALM] on the front surface of the controller turns red, the alarm goes off.

⚠ Caution

When an alarm is generated

Confirm the content of the alarm with 7-segment LED of the controller or I/O output.

Eliminate the cause referring to **12.　Alarm detection (P.61)**.

(5) Data (Operation pattern) setting

Set the stop position, speed, acceleration, and deceleration for the operating directions with the buttons and switches on the controller. Operations other than position setting, jog/inching can be performed after returning to origin position. Refer to **7. Setting method (P.23)** for the details of settings.

(6) Test run

Test run is performed with the buttons and switches of the controller or I/O signal. Refer to **7.1 Setting procedure (P.24)** and **6.3 Parallel input / output signal (P.20)** for details.

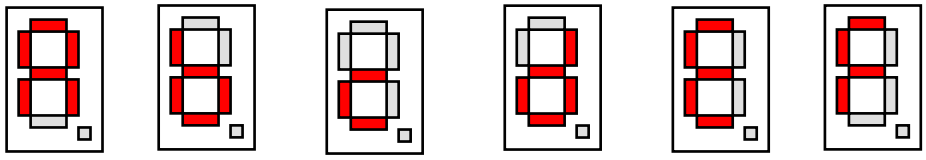
3. Specifications

3.1 Basic specifications

Basic specifications of the product.

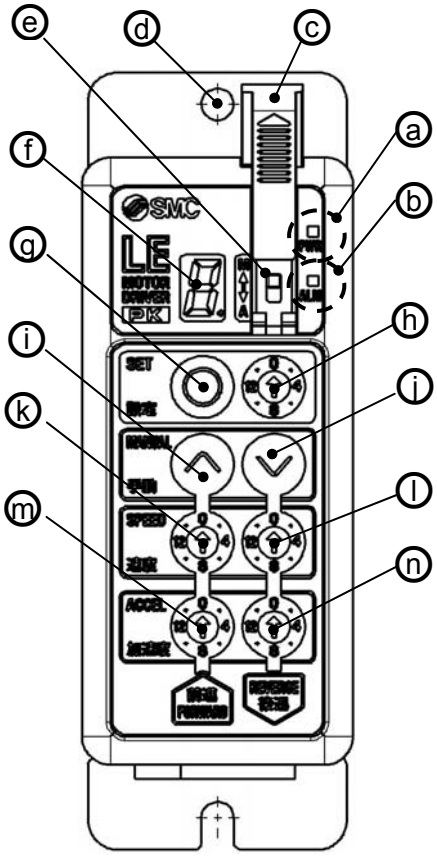
Item	Specifications
Controlled motor	Step motor(servo 24VDC)
Power supply specification (*1)	Power supply voltage: 24VDC±10% Max. current consumption: Rated 3.2A (Peak 5A)(*2) [Includes the motor power supply, control power supply, stop, unlocking]
Parallel input	Input 6 points (Photo coupler insulation)
Parallel output	Output 6 points (Photo coupler insulation)
Stop points	14 points(Location number 1 to 14(E))
Controlled encoder	Incremental A/B phase Pulse number: 800 pulse/rev
Serial communication	RS485 (Complies with Modbus protocol)
Memory	EEPROM
LED display	LED(Green/Red) 1 for each
7-segment LED display (*3)	1 digit, 7-segment display (red) Figures are expressed in hexadecimal (10 to 15 in decimal number are expressed as A to F)
Locking	With unlocking terminal
Cable length	I/O cable: 5m or less Actuator cable: 20m or less
Cooling method	Air-cooling type
Operating temperature range	0 to 40°C(No condensation, no freezing)
Operating humidity range	90%RH or less (No condensation)
Storage temperature range	-10 to 60°C(No condensation, no freezing)
Storage humidity range	90%RH or less (No condensation)
Insulation resistance	Between the case (Heat Sink) and SG terminal: 50MΩ(500VDC)
Weight	130g

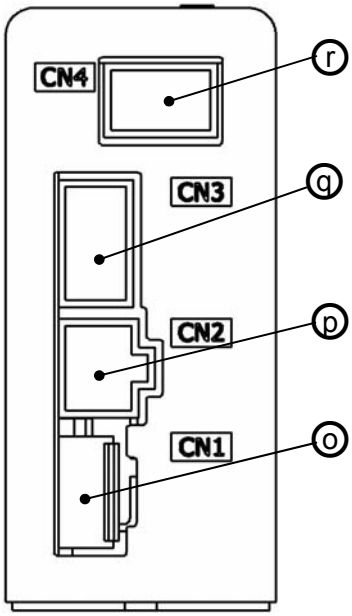
*1) Do not use inrush current suppressor types as the power supply for the controller input.
*2) Power consumption depends on actuator. Please refer to the operation manual of actuators for details.
*3) "10" to "15" in decimal number are displayed as follows in the 7-segment LED



Decimal display	10	11	12	13	14	15
Hexadecimal display	A	b	c	d	E	F

3.2 Details of the controller

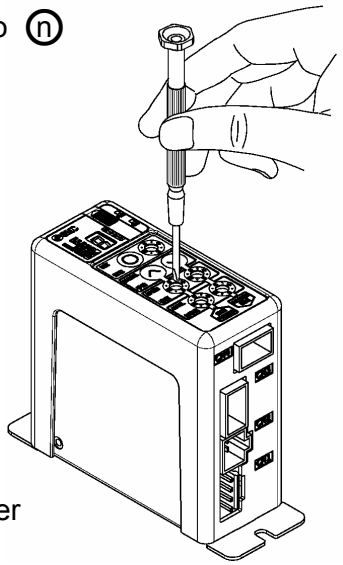




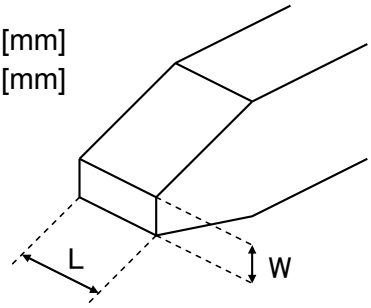
No.	Display	Description	Details
ⓐ	PWR	Power supply LED	Power supply ON／No alarm : Green turns on Power supply ON／servo OFF : Green flashes
ⓑ	ALM	Alarm LED	Power supply ON／With alarm : Red turns on Power supply ON／Parameter setting: Red flashes
ⓒ	—	Cover	Change and protection of the mode SW (Close the cover after changing SW)
ⓓ	—	FG	Frame ground (Tighten the bolt with the nut when mounting the controller. Connect the grounding cable.)
ⓔ	—	Mode switch	Switch the mode(Manual mode <-> Auto mode)
ⓕ	—	7-segment LED	Stop position, the value set by ⓗ and alarm information are displayed.
ⓖ	SET	Set button	Decide the settings or drive operation in Manual mode.
ⓗ	—	Position switch	Assign the position to drive(1 to 14), and the origin position.
ⓘ	MANUAL	Forward button	Perform forward jog and inching.
ⓙ		Reverse button	Perform reverse jog and inching.
ⓚ	SPEED	Forward speed switch	16 forward speeds are available.
ⓛ		Reverse speed switch	16 reverse speeds are available
ⓜ	ACCEL	Forward acceleration switch	16 forward acceleration steps are available.
ⓝ		Reverse acceleration switch	16 reverse acceleration steps are available.
ⓞ	CN1	Power supply connector	Connect the power supply cable
ⓟ	CN2	Motor driving connector	Connect the motor connector.
ⓠ	CN3	Encoder connector	Connect the encoder connector
ⓡ	CN4	I/O connector	Connect I/O cable

⚠Caution

Use a flat blade watchmaker's screwdriver of the size shown below when changing position switch ⓗ and the set value of the speed/acceleration switch ⓚ to ⓝ



<Size>
End width L : 2.0 to 2.4 [mm]
End thickness W : 0.5 to 0.6 [mm]

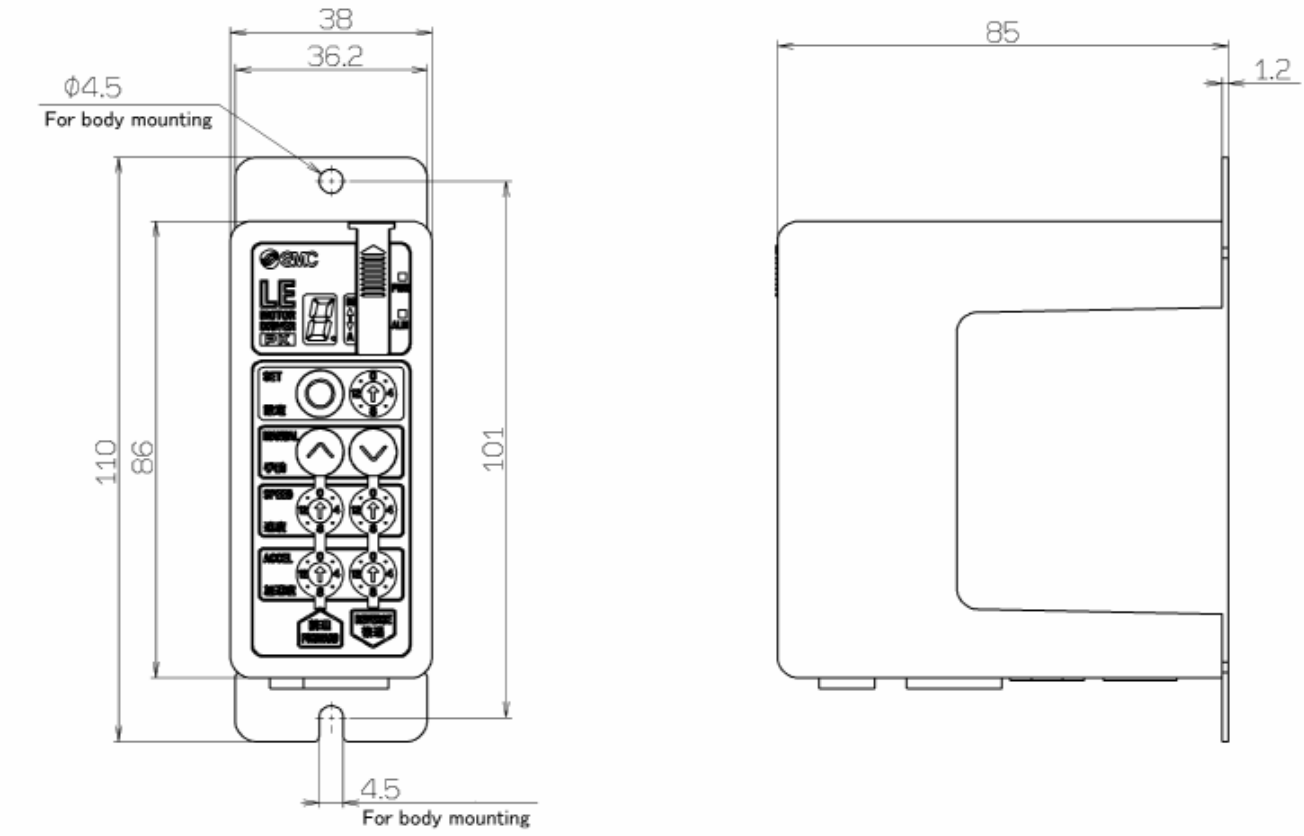


Magnified view of the end of the flat blade screwdriver

3.3 Outer dimensions

The appearance of the product is shown below.

(1)Mounting screw （LECP1□□－□）



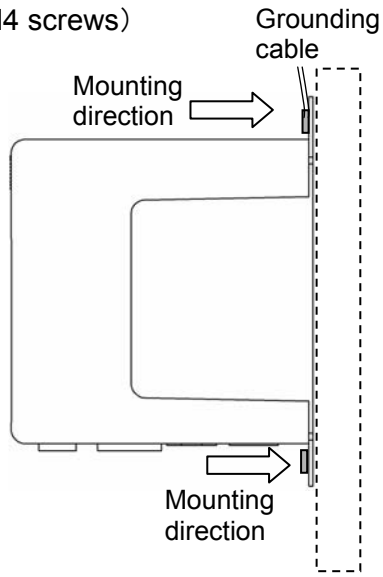
3.4 Mounting

(1) Mounting

Details of the controller.

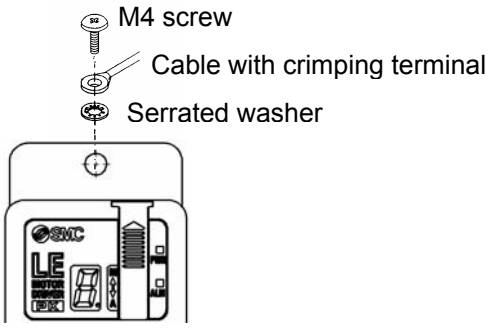
Mounting screw （LECP1□□－□）

（Mounting with two M4 screws）



(2) Grounding

Tighten the bolt with the nut when mounting the ground cable as shown below.



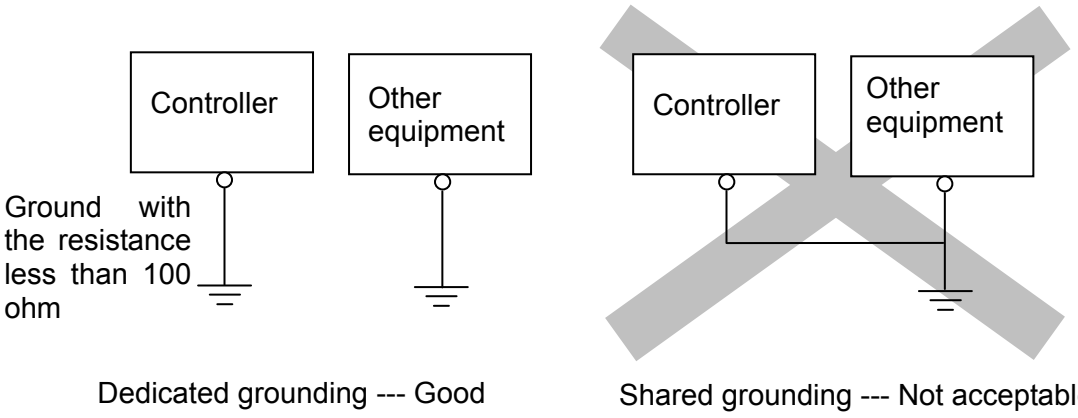
Controller

⚠ Caution

M4 screws, cable with crimping terminal and serrated washer are prepared by customer.
Ground the controller to reduce noise.

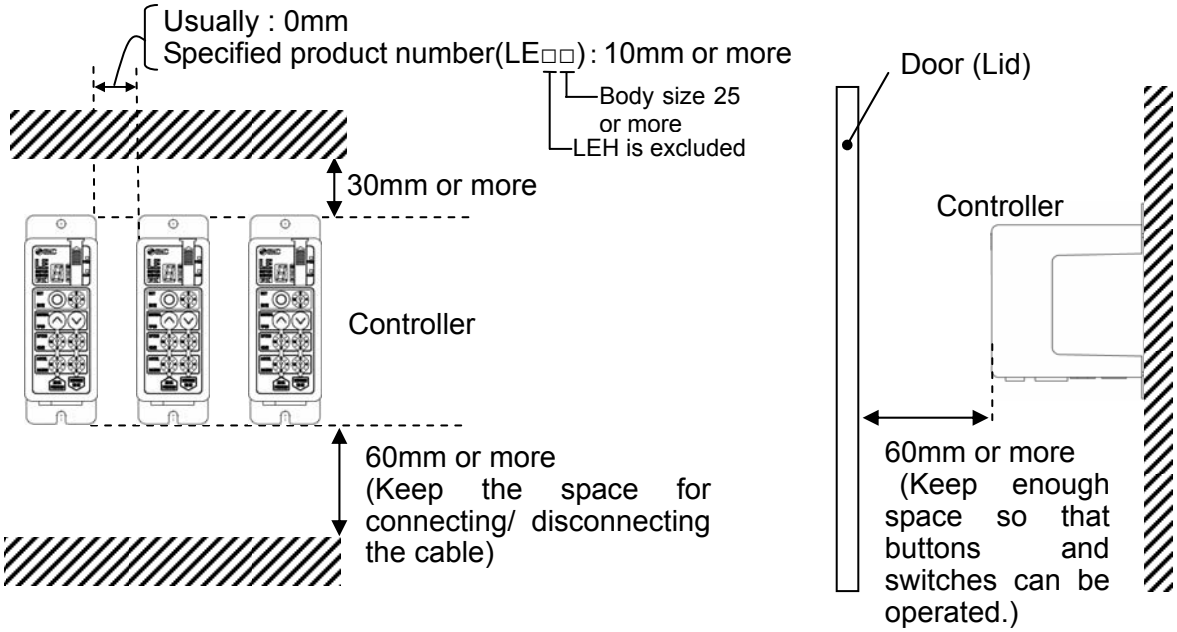
⚠ Caution

(1) Grounding shall be done by dedicated cable. Grounding with the ground resistance of 100Ω or less.
(2) The cross sectional area of the grounding cable shall be 2mm^2 or more.
Grounding location shall be in the vicinity of the controller. Keep the grounding cable short.



(3) Location for mounting

Select the size and the installation style so that the surrounding temperature of the controller is 40°C or less.
Mount the controller vertically on the wall with 60mm or more of space on top and bottom of the controller for connecting and disconnecting of the cable.
Keep 60mm or more between the front of the controller and the cover (lid) so that buttons and switches can be operated.
Keep enough space around the controller so that the operating temperature of the controller stays within the specification range.
Avoid mounting on a panel where a vibration source such as large size electromagnetic contactor or circuit fuse breaker is also mounted.


Usually : 0mm
Specified product number(LE□□) : 10mm or more
Body size 25 or more
LEH is excluded
30mm or more
Controller
60mm or more
(Keep the space for connecting/ disconnecting the cable)
Door (Lid)
Controller
60mm or more
(Keep enough space so that buttons and switches can be operated.)

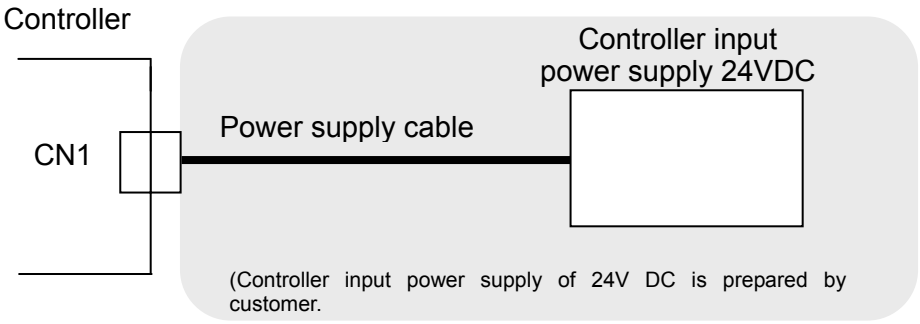
⚠ Caution

When there are dents, bumps or warping on the mounting surface of the controller, excessive force can be applied to the case, which can cause failure. Mount on a flat surface.

4. External connection

4. 1 CN1: Power supply connector

The example of standard wiring of the controller is shown per connector (CN1 to 4).



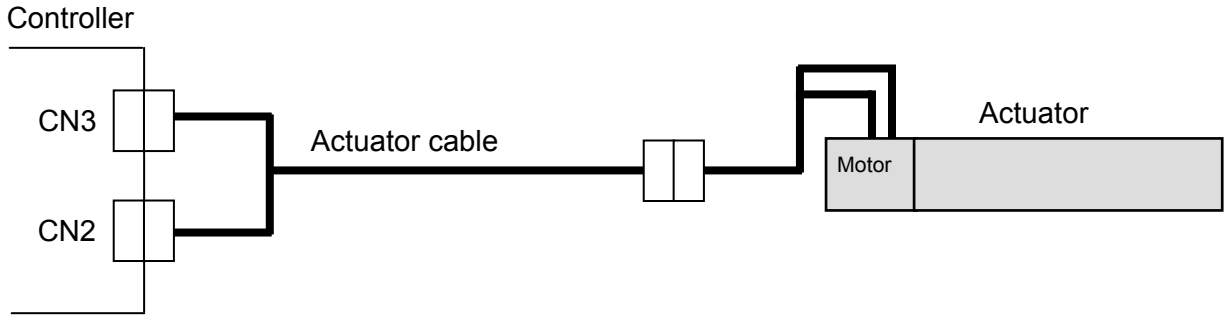
Refer to **5. CN1: Power supply cable(P.16)** for wiring.

⚠Caution

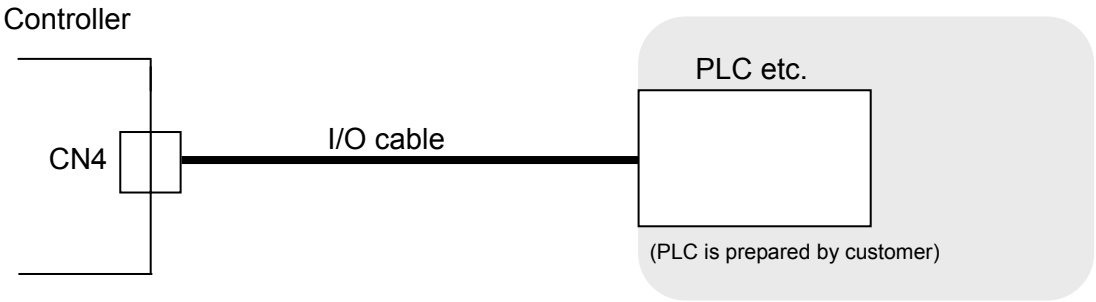
Do not use inrush current suppressor type as the power supply for the controller input.

4. 2 CN2: Motor connector, CN3: Encoder connector

Connect the controller and the actuator with the actuator cable (LE-CP-□ or LE-CP-□S).



4. 3 CN4: Parallel I/O connector



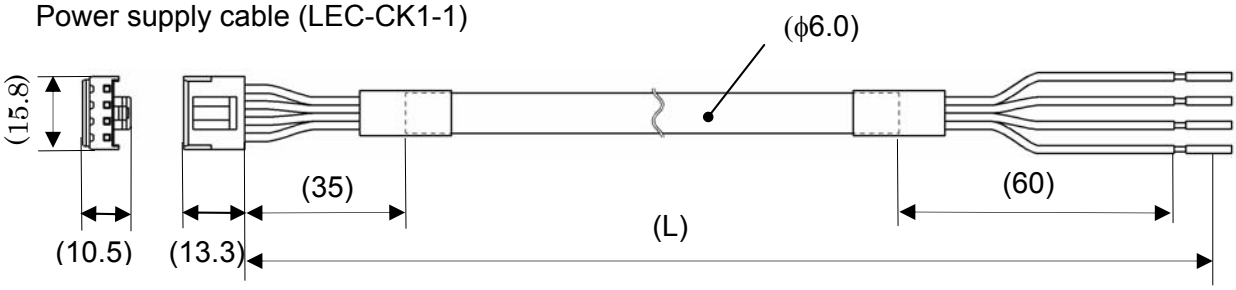
* Refer to **6.4 Parallel I/O connector wiring (Example) (P.22)** for wiring.
* Refer to **6.3 Parallel input / output signal (P.20)** for details

5. CN1: Power supply cable

5. 1 Power supply cable specification

Included power supply cable specification is shown below.

Power supply cable (LEC-CK1-1)



Item	Specifications
Connector	Manufacturer: J.S.T. Mfg. Co.,Ltd. Product number ：VHR-4N
Cross sectional area of the cable	AWG20
Length (L)	LEC-CK1-1：1.5m only

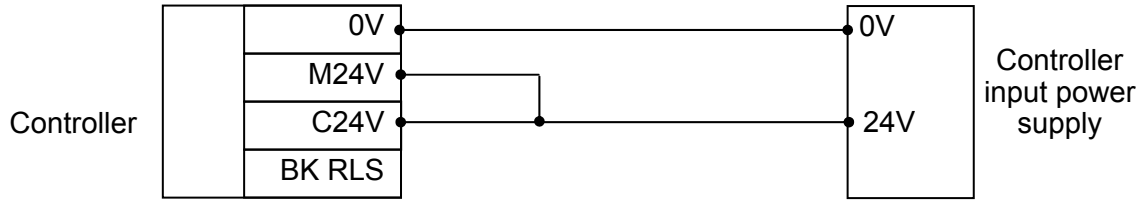
Terminal	Color of covered wire	Function	Functional explanation
0V	Blue	Common power supply (-)	Common for motor supply, controller supply, and brake release.
M24V	White	Power supply of motor (+)	Power for the motor supplied through the controller
C24V	Brown	Power supply (+) for the controller	Power supply for the controller
BK RLS	Black	Unlocking (+)	Unlocks the brake for maintenance

5. 2 Power supply cable specification

Referring to (1) to (4), connect the power supply cable included in accessories to the controller input power supply 24VDC and insert it to the controller CN1 power supply connector.

(1) Wiring of power supply

Connect the plus (+) of the controller input power supply 24VDC to C24V terminal of the power supply cable, and connect the minus (-) to 0V terminal.

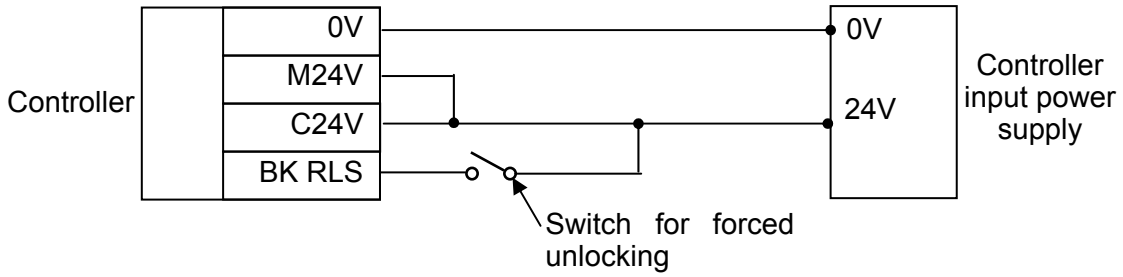


⚠ Caution

Do not use inrush current suppressor type as the power supply (24VDC) for the controller input.

(2) Wiring for the switch for forced unlocking

Install unlocking switch for the adjustment or recovery during emergency of the locking actuator.
* Switch (24V DC, contact capacity 0.5A or more) is provided by customer.
Connect one of unlocking switch terminals to the input power supply for the controller, and the other to BK RLS terminal of the power supply plug. Locking mechanism is released by closing the switch.



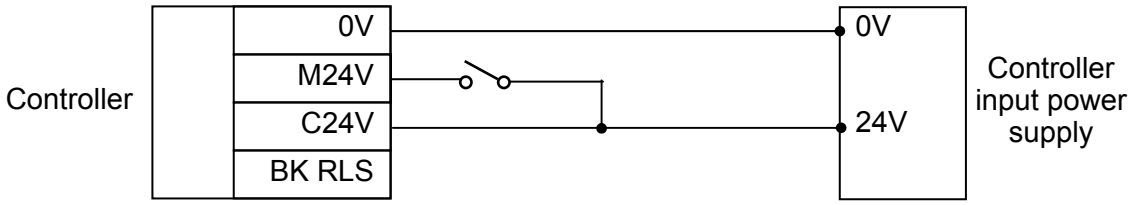
⚠ Caution

It is unnecessary to connect BK RLS terminal when the actuator does not have locking mechanism.

Connect BK RLS terminal only when releasing the lock at servo OFF or STOP is ON is needed.

(3) Wiring for the stop switch

Stop switch is necessary.



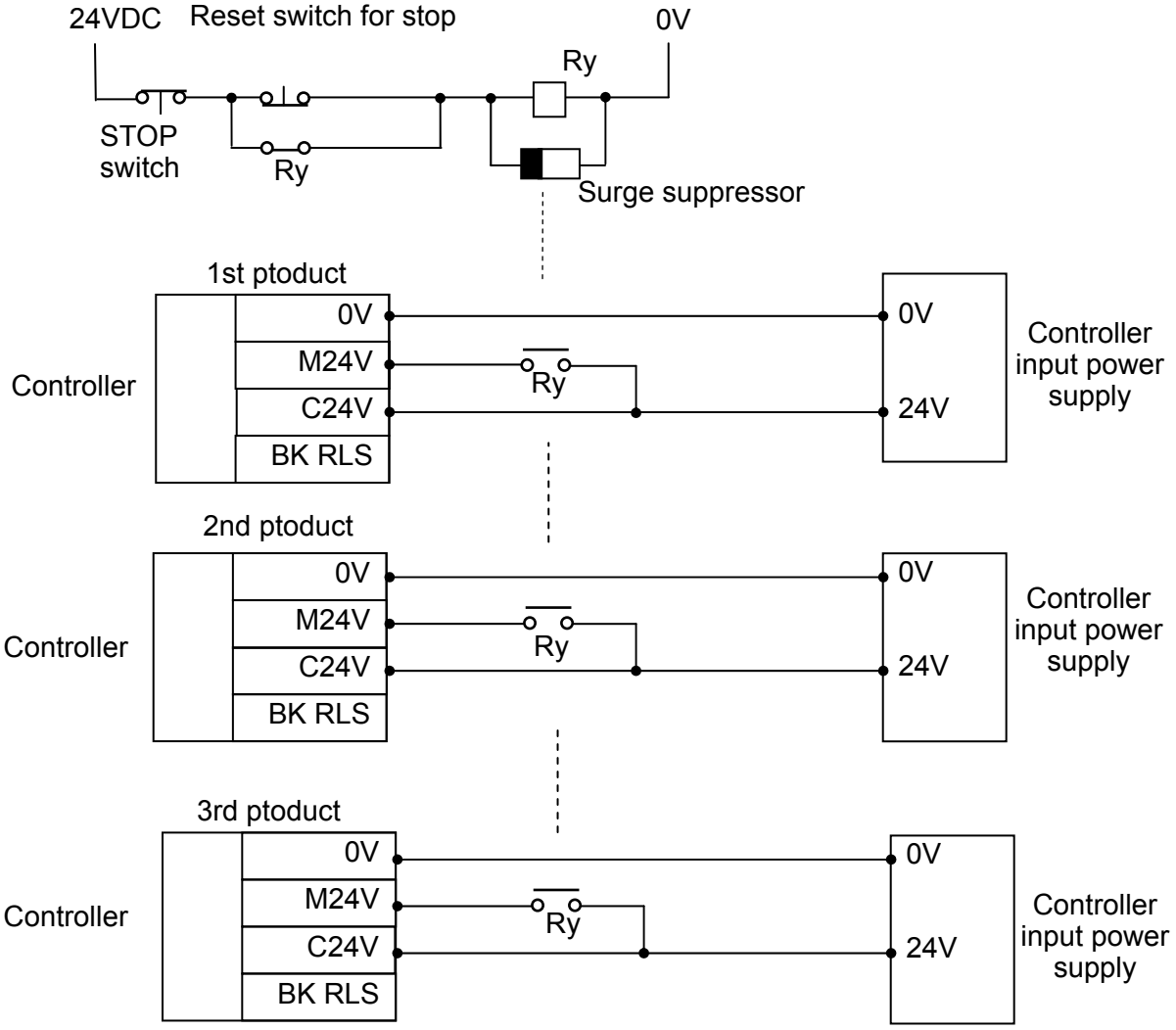
The actuator stops when M24V is turned off. When M24V is turned off in the actuator operation, the alarm is detected.

When the STOP signal is turned on, the actuator stops. At this time, the alarm is not detected.

(4) Stop the power supply for the motor

If it is necessary to shut off the power supply for the motor from outside, connect the relay between the input power supply for the controller 24VDC and the power supply plug for the controller M24V.

【Example of the circuit】



⚠ Warning

- Do not perform returning to origin position neither drive operation when the the power supply for the motor (M24V) is shut off, otherwise alarm will be generated.
- The controller does not recognize the correct origin position with the command for returning to the origin position at the time of the shutoff of the power supply for the motor (M24V).

6. CN4: Parallel I/O cable

6.1 Paralles input / output

■Input specifications

NO.	Item	Specifications
1	Input circuit	Internal circuit and the photo coupler insulation
2	No. of inputs	6 points
3	Voltage	DC24V±10%
4	Input current at ON	3.5mA±20%(at DC24V)
5	Input current / voltage at OFF	1.5mA or less of current 11V or less of voltage

■Output specifications

NO.	Item	Specifications
1	Output circuit	Internal circuit and the photo coupler insulation
2	No. of output	6 opints
3	Maximum voltage between terminals	DC30V
4	Maximum output current	10mA
5	Saturation voltage between terminals	2.0V (Maximum)

6.2 Parallel input / output circuit (NPN, PNP)

There are two types of parallel input / output types for this controller.

NPN type （LECP1N□□－□）

PNP type （LECP1P□□－□）

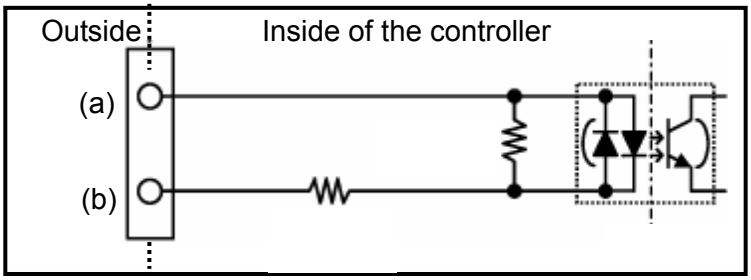
(1) Parallel I/O input circuit (NPN, PNP common)

■ NPN TYPE

(a)	「COM+」〈1〉
(b)	IN0〈9〉～STOP〈14〉

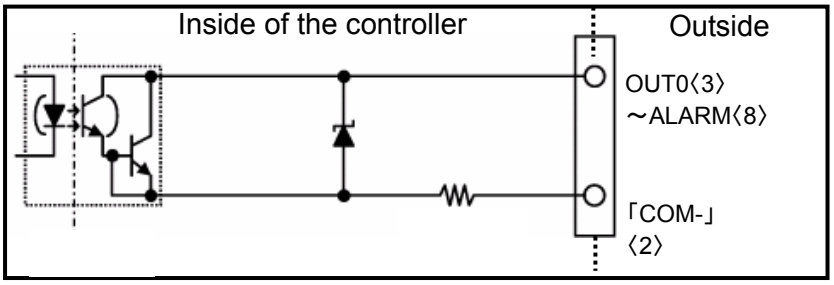
■ PNP TYPE

(a)	「COM-」〈2〉
(b)	IN0〈9〉～STOP〈14〉

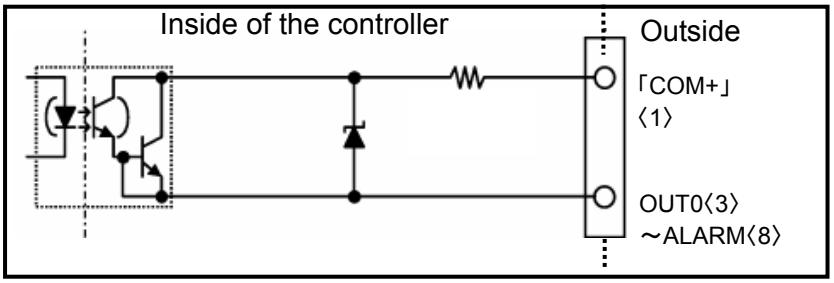


(2) Parallel I/O output circuit

NPN TYPE

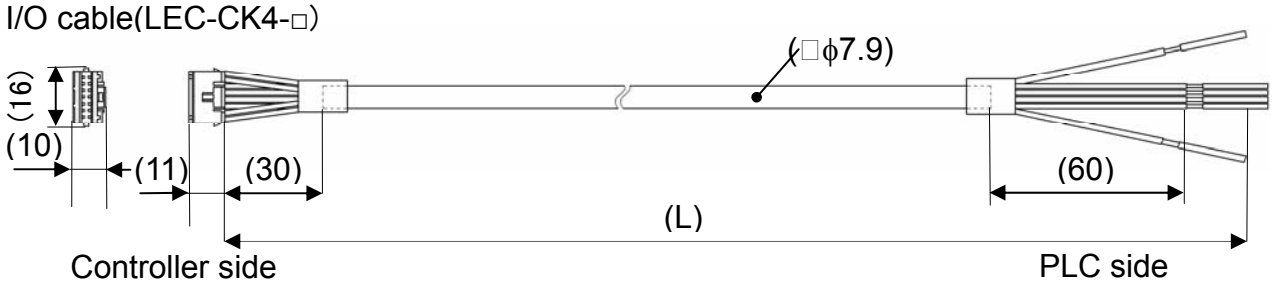


PNP TYPE



6.3 Parallel input / output signal

I/O cable(LEC-CK4-□)



Item	Specifications
Connector	Manufacturer: J.S.T. Mfg. Co.,Ltd.Manufacturer: J.S.T. Mfg. Co.,Ltd. Product number ：PADP-14V-1-S
Cross sectional area of the cable	AWG26
Length（L）	The suffix of the part number (1,3,5) specifies the length. LEC-CK4-1: 1.5m LEC-CK4-3: 3m LEC-CK4-5: 5m

Terminal No.	Insulation color	Dot Mark	Dot color	Function	Contents
1	Light brown	■	Black	COM＋	Connect the 24V side of the power supply (24VDC) for input / output signal.
2	Light brown	■	Red	COM－	Connect the 0V side of the power supply (24VDC) for input / output signal.
3	Yellow	■	Black	OUT0	Operation completion output (Output with the combination of OUT0 to 3) OUT3 / OUT2 / OUT1 / OUT0 OFF / OFF / ON / ON
4	Yellow	■	Red	OUT1	
5	Light green	■	Black	OUT2	
6	Light green	■	Red	OUT3	
7	Gray	■	Black	BUSY	BUSY signal (Output during operation)
8	Gray	■	Red	ALARM	ALARM signal N.C. (Turned off during alarm or when servo is turned off)
9	White	■	Black	IN0	・Operation command input (Input with thecombination of IN0 to IN3) ・Input return to origin position command (Turn on IN0 to 3 simultaneously) Ex. (Commands position number 5 to operate) IN3 / IN2 / IN1 / IN0 OFF / ON / OFF / ON
10	White	■	Red	IN1	
11	Light brown	■■	Black	IN2	
12	Light brown	■■	Red	IN3	
13	Yellow	■■	Black	RESET	Interruption or alarm reset During operation: The speed is reduced from the point where signal is input until the actuator stops. (Servo stays ON) Alarm is being generated: Alarm reset
14	Yellow	■■	Red	STOP	STOP command (Sudden deceleration to turn off servo)

* Parallel I/O signal is valid in auto mode. STOP signal is valid in auto mode and manual mode.
While the test function operates at manual mode, only the output is valid.

The change of I/O output signal under the condition of controller at auto mode.

Condition of the controller	Output signal					
	OUT0	OUT1	OUT2	OUT3	BUSY	ALARM
Supply of power	OFF	OFF	OFF	OFF	OFF	OFF
After supplying power and at the stop before returning to origin position	OFF	OFF	OFF	OFF	OFF	ON
During the returning to origin position, positioning, and pushing operation.	OFF	OFF	OFF	OFF	ON	ON
When return to origin position is completed.	ON	ON	ON	ON	OFF	ON
During the return to origin position, positioning, and pushing operation.	*1	*1	*1	*1	OFF	ON
Stopped by RESET command	OFF	OFF	OFF	OFF	OFF	ON
Stopped by STOP command	OFF	OFF	OFF	OFF	OFF	OFF
When alarm is generated	OFF	*2	*2	*2	OFF	OFF

*1 ON, OFF of OUT0 to 3 depends on the target position
*2 ON and OFF of OUT0 to 3 depends on the alarm group.

There is no servo ON signal with this controller. The servo turns off when conditions to turn off the servo are satisfied. Refer to **8.5 Servo ON (P.43)** for details.

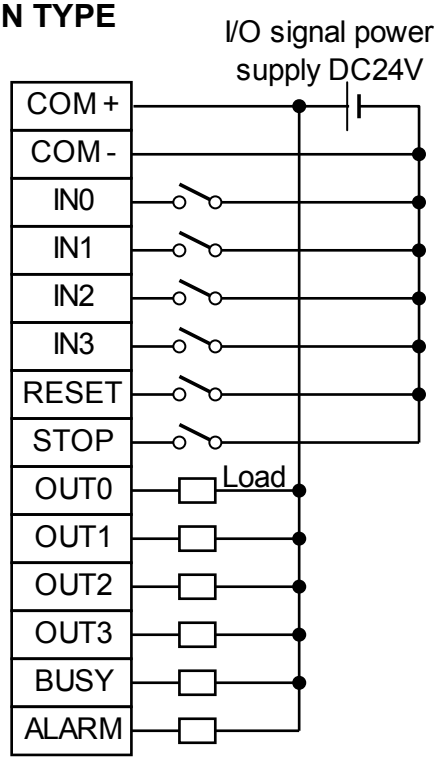
⚠ Caution

- Signal is not output from I/O right after switching from manual mode to auto mode. Output from I/O is made after the next input of operation command.
- Output from I/O is not made if switching from auto mode to manual mode.

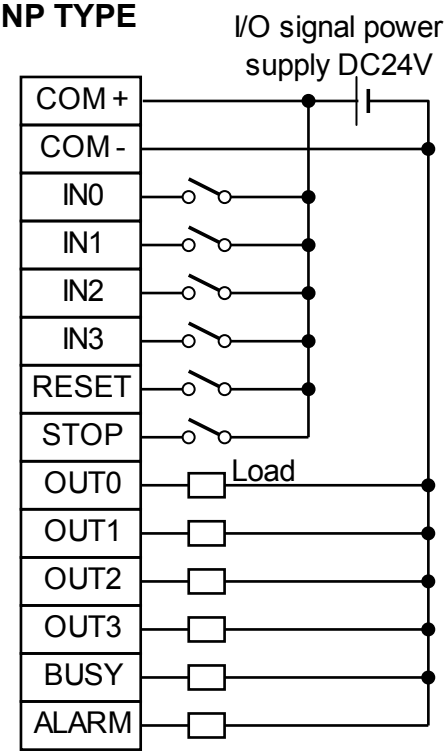
6.4 Parallel I/O connector wiring (Example)

Use an I/O cable (LEC-CK4-□) when connecting to PLC and CN4 parallel I/O connectors.
Wiring depends on the parallel input/output of the controller (NPN, PNP type).
Please wire the product referring to the wiring diagram,

■NPN TYPE



■PNP TYPE



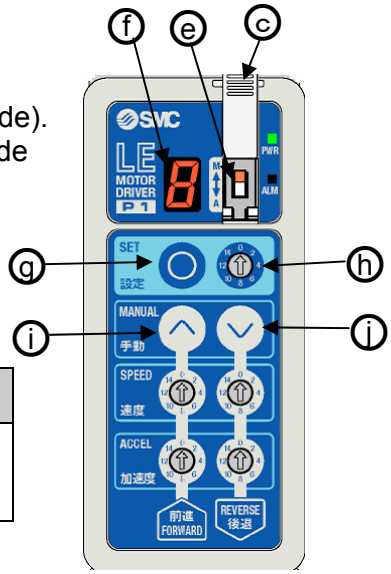
⚠Caution

Prepare separate 24VDC power supplies for the CN1 controller input power supply and CN4 input / output signal power supply.

7. Setting method

It is necessary to set the stop position and operation method using the controller in order to move the actuator to the specified position. Set data is stored in the memory in the controller

Up to 14 points can be set. Set "1" to "14" with the position switch ⓗ. ("1" to "9", "A" to "E") is displayed in hexadecimal on the 7-segment LED ⓕ.



There are 2 types of modes on the controller (manual mode, auto mode). Setting and operating methods are different. Mode is switched by mode Switch ⓔ.

Upper part of the right figure(M) : Manual mode
Lower part of the right figure(A) : Auto mode

⚠ Caution

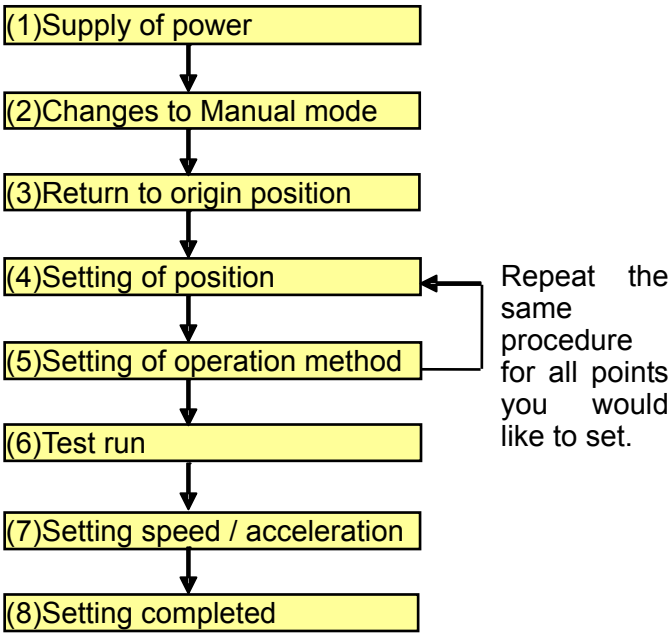
Close the cover ⓒ after the switching the mode to avoid unexpected mode changes.

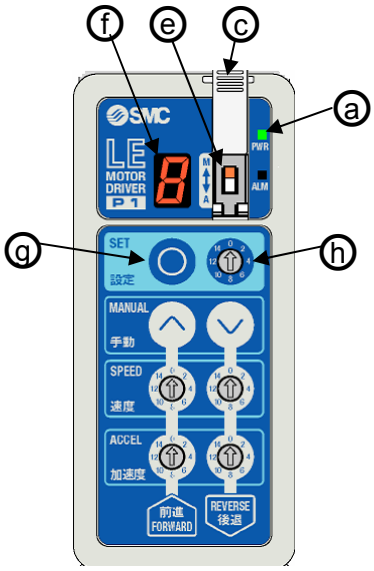
	Manual mode(M)	Auto mode(A)
Setting of stop position (step data)	O	X
Setting of Speed and Acceleration	O	Δ(Only in speed adjustment)*2
Setting of operation method	O	X
Setting parameters	O	X
Controller operation using the button	O	X
Operation from parallel I/O	X	O
Positioning operation	O	O
Pushing operation	Δ(Test function only)*1	O
Output to parallel I/O	Δ(Test function only)*1	O
Check the presence of alarm	O	O
Check the content of alarm	O	O
How to release the alarm	Press set button ⓖ	Turn on RESET or press set button ⓖ
Servo OFF method	Turn off Servo Press Forward button ⓘ and Reverse button ⓙ simultaneously for 3 sec.	Turn on STOP

*1 Refer to **7.4 Test function (P.38)** for details of test function.
*2 Refer to **7.3 Controller modes (P.34)** for details of the adjustment of the speed.

7.1 Setting procedure

Follow the procedure below for setting.


(1)Supply of power
(2)Changes to Manual mode
(3)Return to origin position
(4)Setting of position
(5)Setting of operation method
(6)Test run
(7)Setting speed / acceleration
(8)Setting completed
Repeat the same procedure for all points you would like to set.



(1)Supply of power

Apply 24VDC to the power supply for the power line and the signal line. After applying the power, confirm that the power supply LED ⓐ lights green (=Servo ON). Refer to **8.5 Servo ON (P.43)** if the power supply LED ⓐ flashes green.

(2) Changes to Manual mode

Switch the controller mode switch ⓔ to manual mode (M). In manual mode, the 7-segment LED ⓕ indicates the value of the position switch ⓗ with high speed flashing.

(3) Return to origin position

Confirm that the 7-segment LED ⓕ display is changed to "F" by setting the position switch ⓗ to "15", then press the set button ⓖ to start the return to origin. When the return to origin is completed, the display of the 7-segment LED ⓕ changes changes from flashing to solid.

⚠ Caution

- If you perform return to origin before the servo is turned on (Power supply LED ⓐ lights up in green) an alarm will be generated. Perform the return to origin after confirming that the servo is turned on.
- Refer to **8.1 Returning to origin position(P.39)** for details.
- The direction of return to home depends on the actuator. Refer to **10. Initial setting value per actuator (P.48)**.

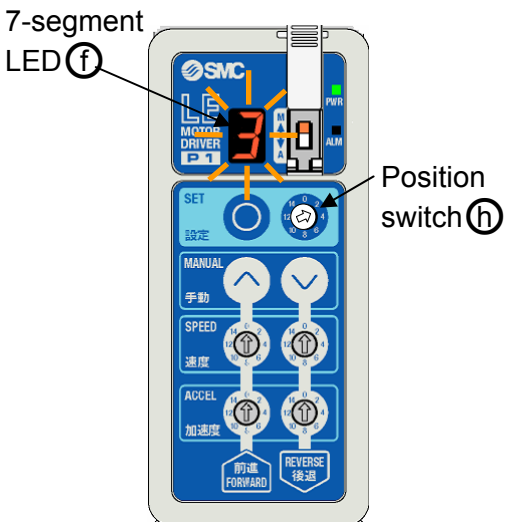
(4), (5) Setting of position and operation method

At the manual mode after returning to origin, position can be set by (A) Jog / inching or (B) Direct teaching. Example) Setting of position number 3

(A) Setting by Jog / inching

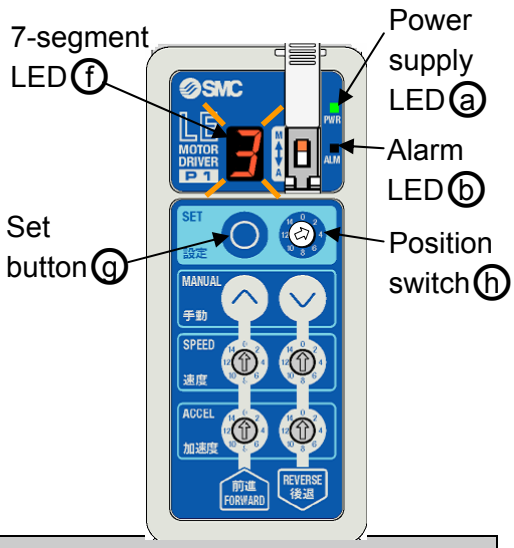
[1] Set the position switch ⓗ to the position you desire ("3" in this case). The value of position switch ⓗ flashes in high speed on 7-segment LED ⓕ

* Do not set "0" and "F(15)", They are not not available for position numbers.



[2] Confirm that the power supply LED ⓐ is ON, then, press the set button ⓖ to the set position. 7-segment LED ⓕ lights up when the set position is reached. Continuing to press the set button makes the LED flash slowly. Release the set button ⓖ.

* If you release the set button ⓖ the operation stops in the middle. If you release the set button ⓖ in the middle of the operation, press the button again to move on to the next procedure.

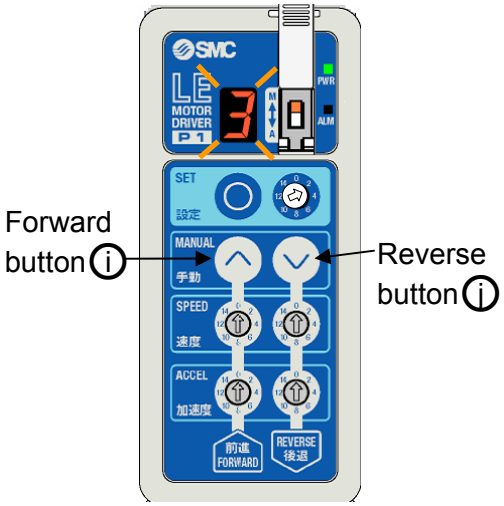


⚠ Caution

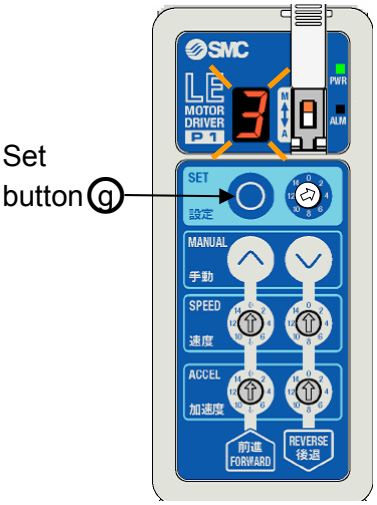
- If you perform procedure [2] before returning to origin, alarm is generated (7-segment LED ⓕ displays "C" and alarm LED ⓑ lights up) In this case, release the alarm by pressing the set button ⓖ. Set the position switch ⓗ to "F(15)" and press the set button ⓖ for retuning to origin, then perform the procedure [2].
- If it is not possible to return to the position before setting due to the mechanical interference, set the position by (B)Direct teaching.

[3] Perform Jog / inching using Forward button ⓘ, Reverse button ⓙ to move to desired position.

* Jog starts by keeping pressing Forward button ⓘ or Reverse button ⓙ.Refer to **8.4 Jog / inching operation (P.42)** for details.

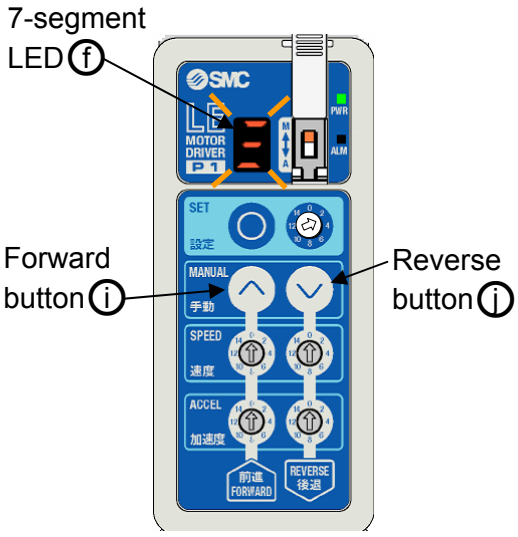


[4] Lock in the position by pressing the set button ⓖ. At this point, the value is not stored if the power supply is cut, it is necessary to started from procedure [1].

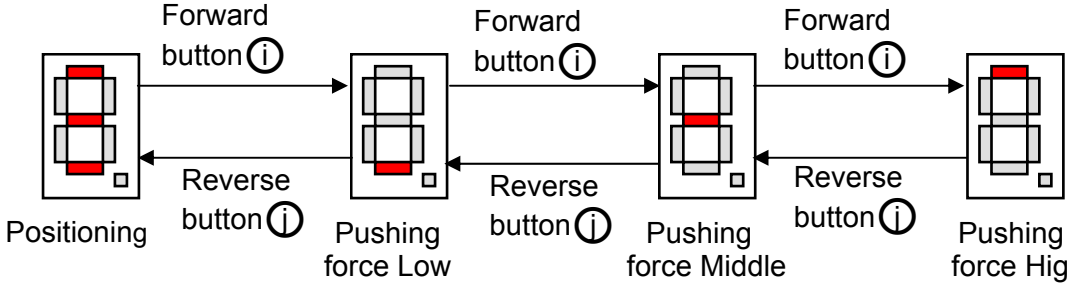


[5] Set the operation method of this position by pressing Forward button ⓘ or Reverse button ⓙ monitoring 7-segment LED ⓕ

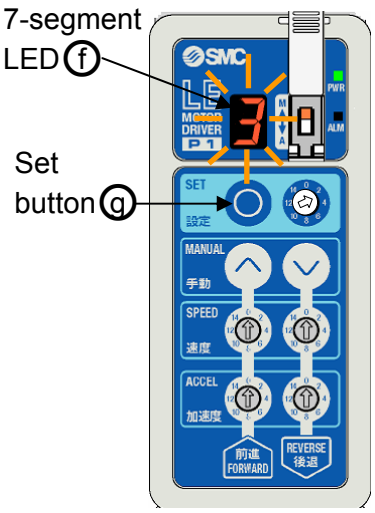
* Actual force of pushing force depends on the actuator. Refer to **10. Initial setting value per actuator (P.48)** Pushing operation may not be possible depending on the actuator.



7-segment LED display (Set operation method)



[6] Press set button ⓖ for 2 sec. to set the operation method. Once this operation is completed, 7-segment LED ⓕ display flashes quickly. The position and the operation method are stored in the controller.



Positioning by jog / inching completed. Do the same for other position numbers you desire to set.

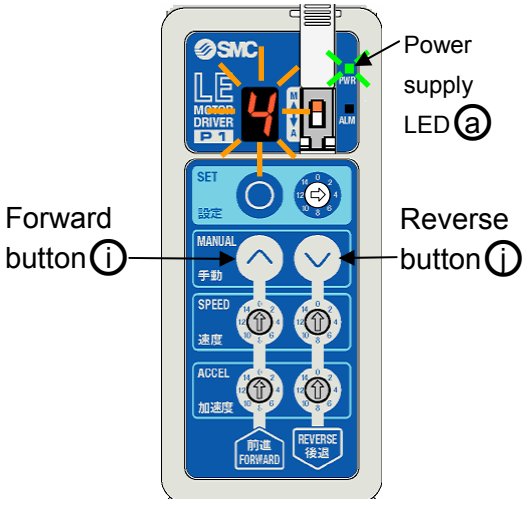
⚠ Caution

- If you perform jog / inching before the servo is turned on (Power supply LED ⓐ lights up in green), alarm is generated. Perform jog / inching after confirming that the servo is turned on.
- Set operation method per position number. Refer to **8. Operations(P.39)**.

(B) Setting by direct teaching (Ex. Position switch initial value "4")

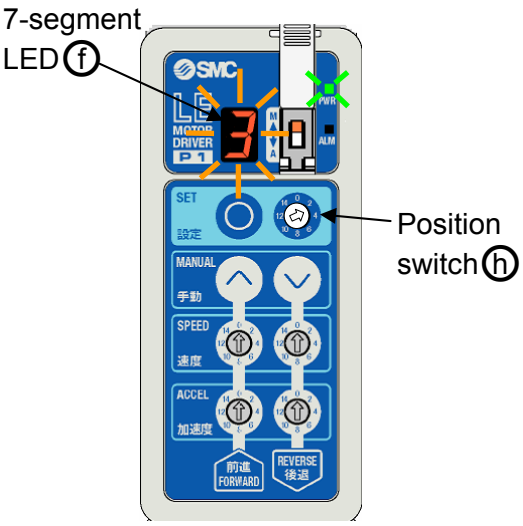
[1] Pressing the Forward button ⓘ and Reverse button ⓙ simultaneously for 3 sec will make the power supply LED flash.

* The flashing of the power supply LED ⓐ indicates the servo is turned off.

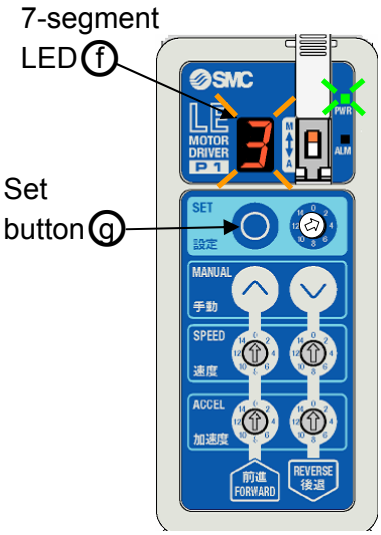


[2] Set the position switch ⓗ to the position you desire ("3" in this case). The value of position switch ⓗ flashes quickly on 7-segment LED ⓕ.

* Do not set "0" and "F(15)", They are not position numbers.



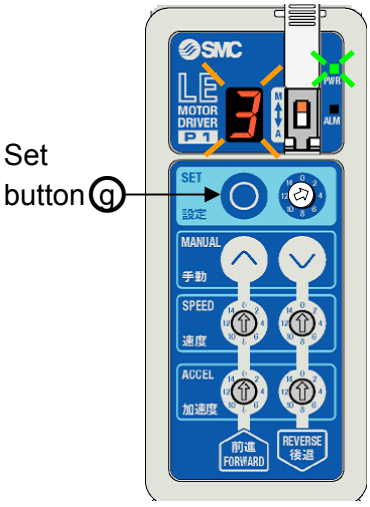
[3] Press and hold the set button ⓖ until 7-segment LED ⓕ changes quick flashing --> solid lighting --> slow flashing.



[4] Move the actuator to desired position with external force. Lock in the position by pressing the set button ⓖ.

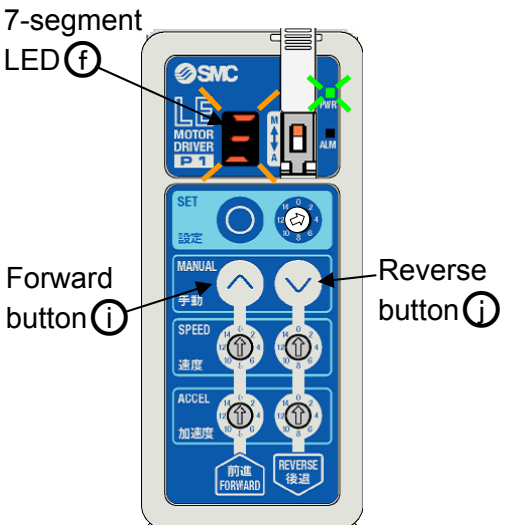
* At this point, the position is not stored, If the power supply is cut, it is necessary to started from procedure [1].

* In case of small lead screws, the actuator may not be moved by external forced even if the servo is off. Perform positioning by (A) jog / inching

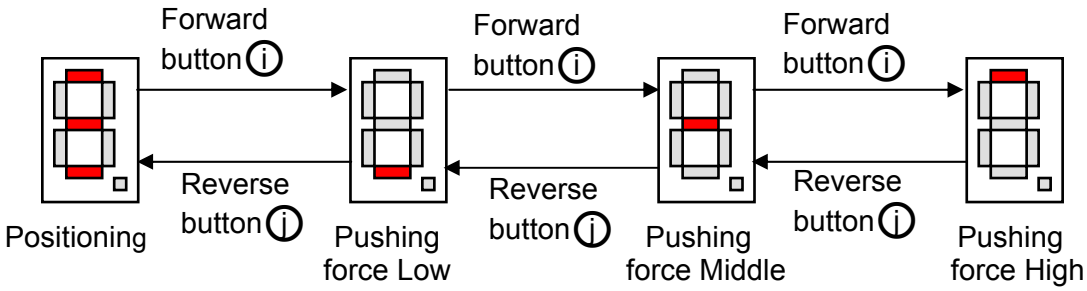


[5] 7-segment LED ⓕ, Set the operation method of this position by pressing the Forward button ⓘ or Reverse button ⓙ while monitoring 7-segment LED ⓕ.

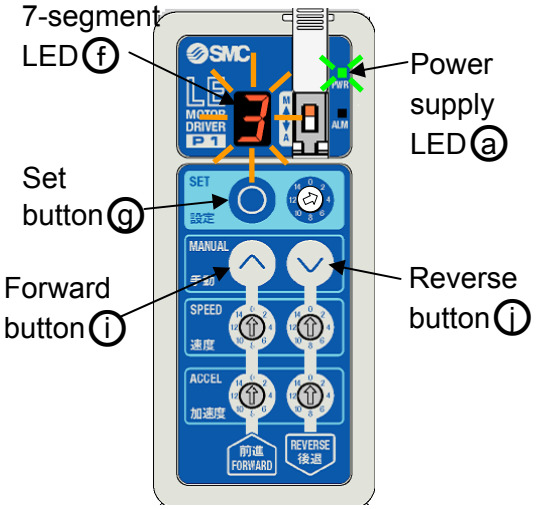
* Actual force of pushing force depends on the actuator. Refer to **10. Initial setting value per actuator (P.48)** Pushing operation may not be possible depending on the actuator.



7-segment LED display (Set operation method)



[6] Press set button ⓖ for 2 sec. to set the operation method. Once this operation is completed, the position and the operation method are stored in the controller, and 7-segment LED ⓕ display flashes quickly.



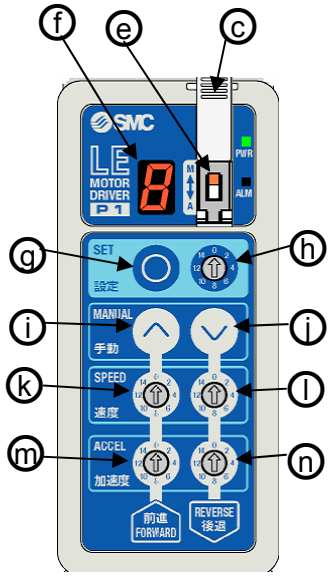
That is all for the setting by direct teaching. If you continue to set other position, start from the procedure [2]. If you perform setting with Jog / Inching or test run, press Forward button ⓘ and Reverse button ⓙ for 3 sec. simultaneously to change the power supply LED ⓐ from flashing to lighting.

⚠ Caution

- Set operation method per position number. Refer to **8. Operations (P.39)**.
- The actuators with a smaller lead, it may not be moved by the external force. Perform positioning by (A) jog / inching in previous page.

(6) Test run

Operate by the controller buttons and the switches to check the operation method and the position.



Operation method is as follows.

1) Set the position switch ⓗ to the position number you desire.
2) Confirm that the position number flashes on the 7-segment LED ⓕ.
3) Press and hold the set button ⓖ. Operation is kept while the button is pressed. 7-segment LED ⓕ flashes slowly during operation. Slow flashing changes to being solid when the set position is reached. This operation confirms the stop position and the operation method.
4) Confirm other stop position with the same operation.

* For Pushing operation, check with the test function of manual mode or auto mode. Refer to **7.4 Test function (P.38)** for details of normal operation and test function.

(7) Setting of Speed and Acceleration

Set the speed and the acceleration by switch ⓚ to ⓝ per direction of actuation. The switch can be set in 16 steps. Actual value depends on the actuator. Refer to **10. Initial setting value per actuator (P.48).** Operation procedure is the same as (6) Test run.

(8) Completion of setting

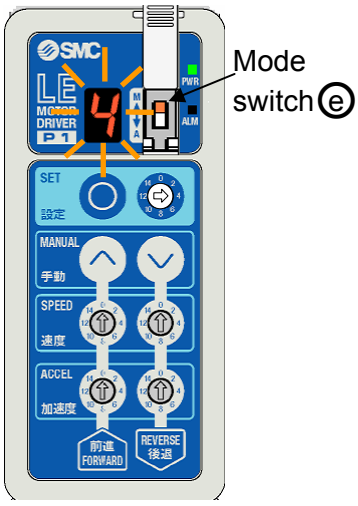
After the setting, the operation can be controlled by switching to auto mode by the mode switch ⓔ. Refer to **9. Operation (Example) (P.44)** for operation of PLC.

⚠Caution
Close the cover ⓒ after the switching of the mode to avoid unexpected mode change.

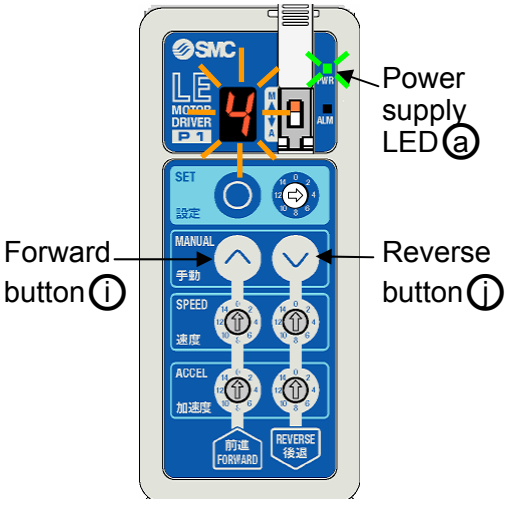
7.2 Setting parameters

In manual mode, it is possible to set parameters when necessary.
Example. Change the jog speed level from "1" (default condition) to "3"

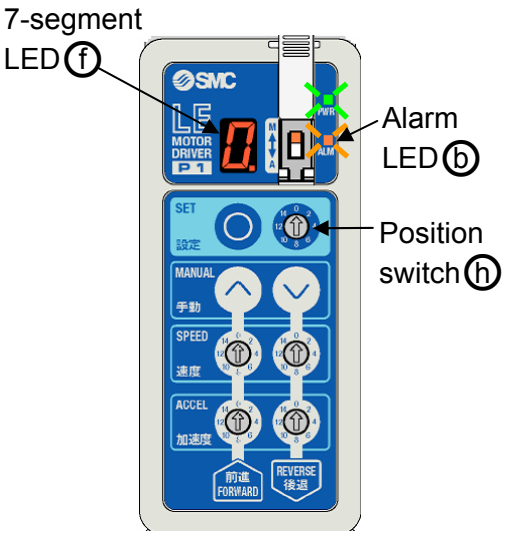
(1)Switch the controller mode switch ⓔ to manual mode (M).
(Example. "4" (Default value of position switch)



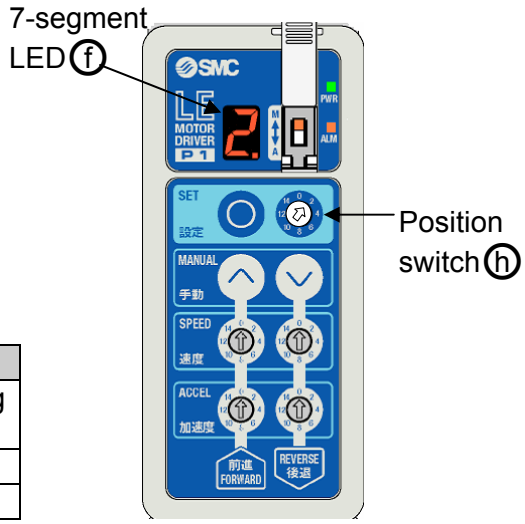
(2)Press the Forward button ⓘ and Reverse button ⓙ simultaneously for 3 sec and the power supply LED ⓐ will flash.



(3)When you set the position switch ⓗ at "0" and press the set button ⓖ for 3 sec., a "0" will be displayed with a dot in the corner of the 7-segment LED ⓕ, and alarm LED ⓑ flashes.



(4) If you set the position switch ⓗ to the parameter No. that you desire ("2" in this case), the value of the position switch ⓗ is displayed with a dot in the corner or the 7-segment LED ⓕ.

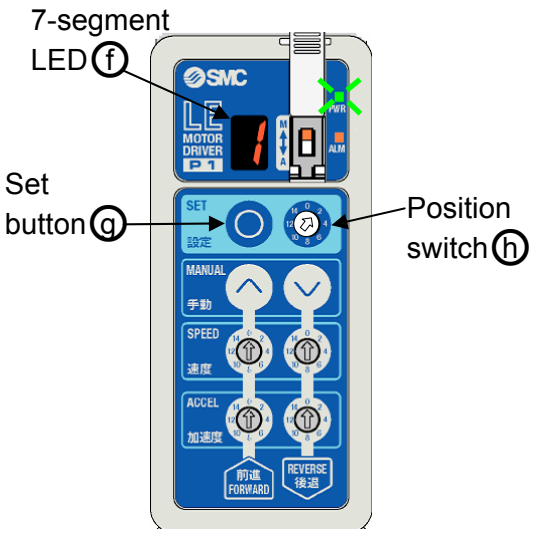


* Refer to the next page for the details of parameters.

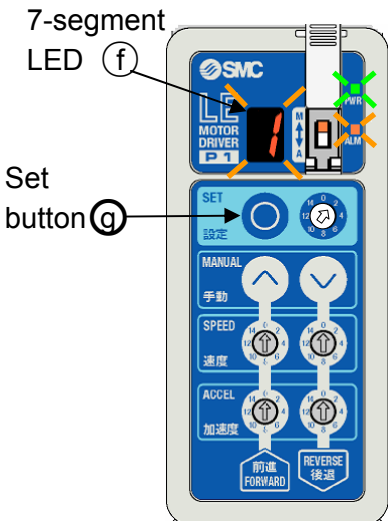
NO.	Description	Function
1	Reference for rotating direction	Return to origin or changing forward / reverse
2	Jog speed level	Adjust the jog speed
3	Inching level	Adjustment of inching

(5) The 7-segment LED ⓕ indication is turned off by pressing the set button ⓖ, and the current parameter appears. ("1" appears in this example).

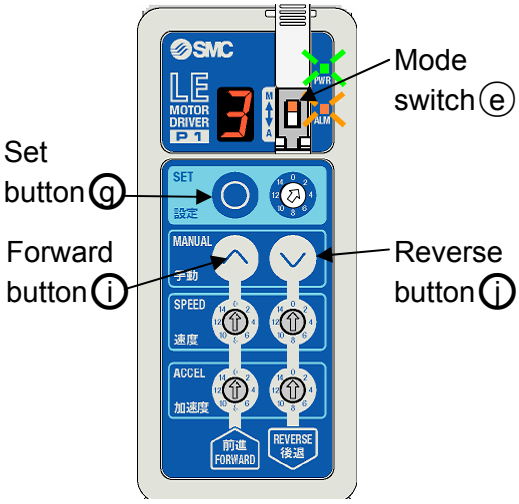
* If you change the value of the position switch ⓗ at this point, it returns to procedure (4).



(6) If you press the set button ⓖ for 2 sec. to change the parameter value, the 7-segment LED ⓕ changes to slow flashing.



(7) Press forward button ⓘ and reverse button ⓙ to adjust the parameter to the desired value ("3" in this example). Press the set button ⓖ for 2 sec. to set after the adjustment.



* When this operation is completed, the 7-segment LED ⓕ display changes from slow flashing to a solid light and the set value is stored. The changes do not take effect until the power is supplied again.

* That is the end for parameter setting. If you continue to adjust other parameters, repeat the procedures (4) to (7). If you start operation in manual mode after changing the settings, set mode switch e to auto mode once, then change the mode to manual mode.

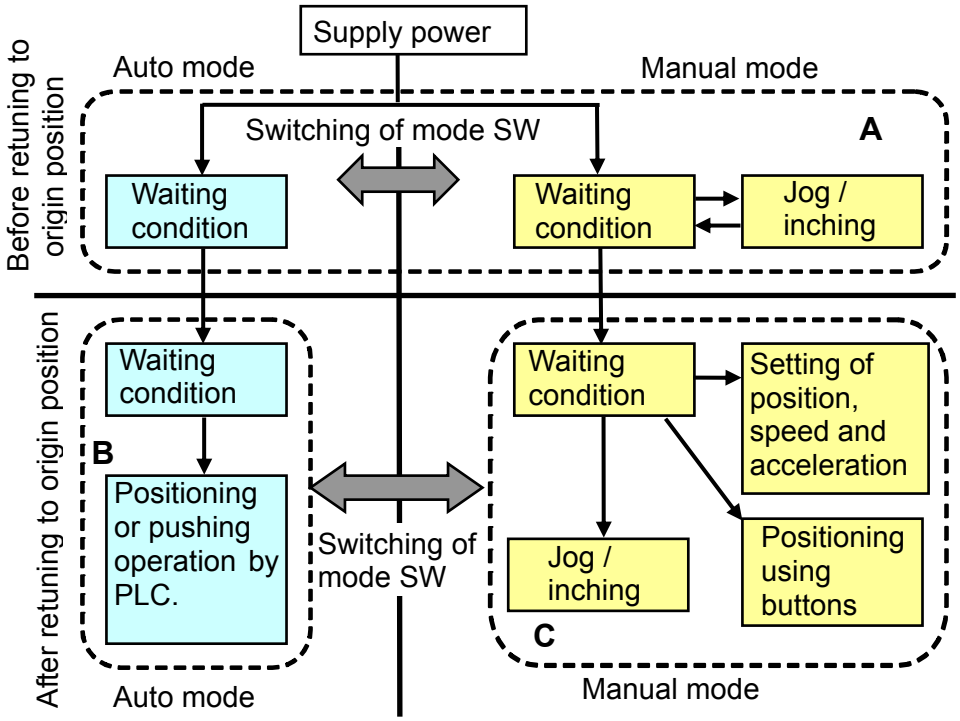
Description of parameters	No. of parameters	Value and the content of parameters
Reference for rotating direction	1	Change the direction of the return to origin and forward and reverse. 1: CW (Default value of LEF and LEH series at the time of shipment) 2: CCW(Dafault value of LES and LEY series at the time of shipment)
Jog speed level	2	Adjust the jog speed 1: Multiplier=1 (Default value at the time of shipment) 2: Multiplier=2 3: Multiplier=3 4: Multiplier=4 Jog speed =(Reference value per actuator)×(Multiplier)
Inching level	3	Adjust the inching amount 1: Multiplier=1 (Default value at the time of shipment) 2: Multiplier=2 3: Multiplier=3 4: Multiplier=4 Inching level =(Reference value per actuator)×(Multiplier)

⚠ Caution

- Parameter changes take effect after turning off the power supply and turning it on again.
- For the default value of the return to origin and the reference value of jog speed and the inching amount, refer to **10. Initial setting value per actuator (P.48)**.
- When you change the reference for rotating direction, change the setting of the speed and acceleration per direction.

7.3 Controller modes

Controller modes are divided into two types, auto mode and manual mode. There are several status types in one mode. The figure below shows how the status changes.



Followings are the explanation of (A)(B)(C) circled with dashed line.

(A) Before returning to origin position

(B) Auto mode after returning to origin position

(C) Manual mode after retuning to origin position

⚠ Caution

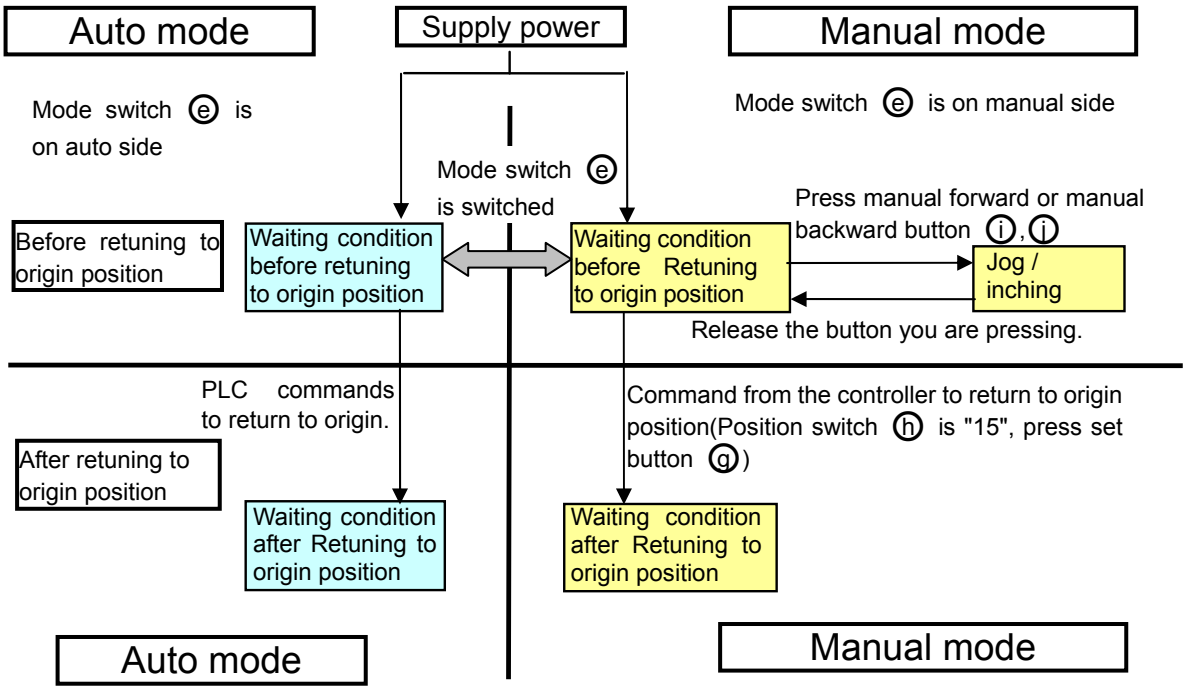
Precaution

●Signal is not output from I/O right after switching from manual mode to auto mode. Output from I/O is made after the next input of operation command.

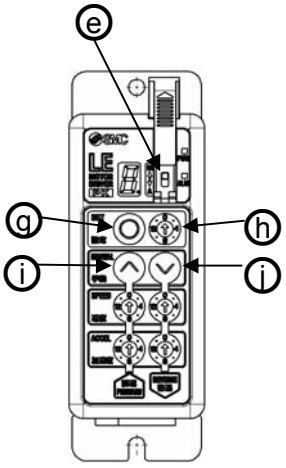
●Output from I/O is not made if switching from auto mode to manual mode. (Except test function)

(A) Before returning to origin position

The transition of the status before returning to origin is shown below. After turning on the power supply, the controller status is in waiting mode which is set by mode switch ⓔ. The operation of jog / inching at manual mode is available before retuning to origin.

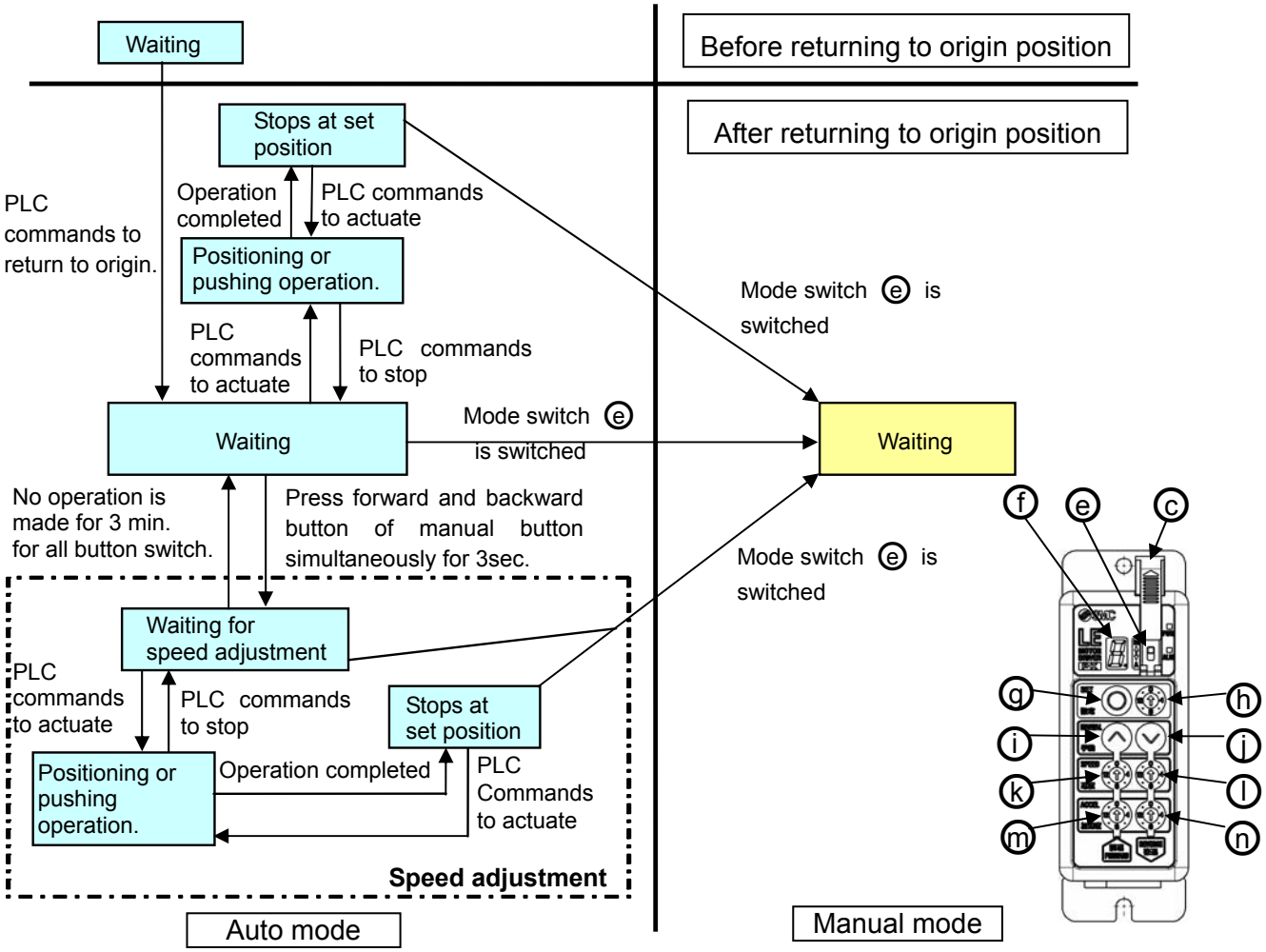

Auto mode
Supply power
Manual mode
Mode switch ⓔ is on auto side
Mode switch ⓔ is on manual side
Mode switch ⓔ is switched
Press manual forward or manual backward button ⓘ, ⓙ
Before retuning to origin position
Waiting condition before retuning to origin position
Waiting condition before Retuning to origin position
Jog / inching
Release the button you are pressing.
PLC commands to return to origin.
Command from the controller to return to origin position(Position switch ⓗ is "15", press set button ⓖ)
After retuning to origin position
Waiting condition after Retuning to origin position
Waiting condition after Retuning to origin position
Auto mode
Manual mode

Refer to **8.1 Returning to origin position (P.39)** for details.
Refer to **8.4 Jog / inching operation (P.42)** for details.

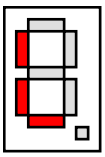


(B) Auto mode after return to origin position

The status of the auto mode after return to origin position is shown below. At auto mode, only the operation command such as I/O from PLC is accepted. Basically, position, operation method, speed and acceleration cannot be adjusted in auto mode.



Auto mode is presuming the operation by I/O from PLC. If you use buttons or switches other than set button ⓖ for releasing the alarm, 7-segment LED ⓕ indicates "L".



L display

When the status is moved to speed adjustment, followings items are become different from normal operation.

(1)More dots of 7-segment LED ⓕ indication than normal operation.

(2)Speed and acceleration adjustment become available temporarily.

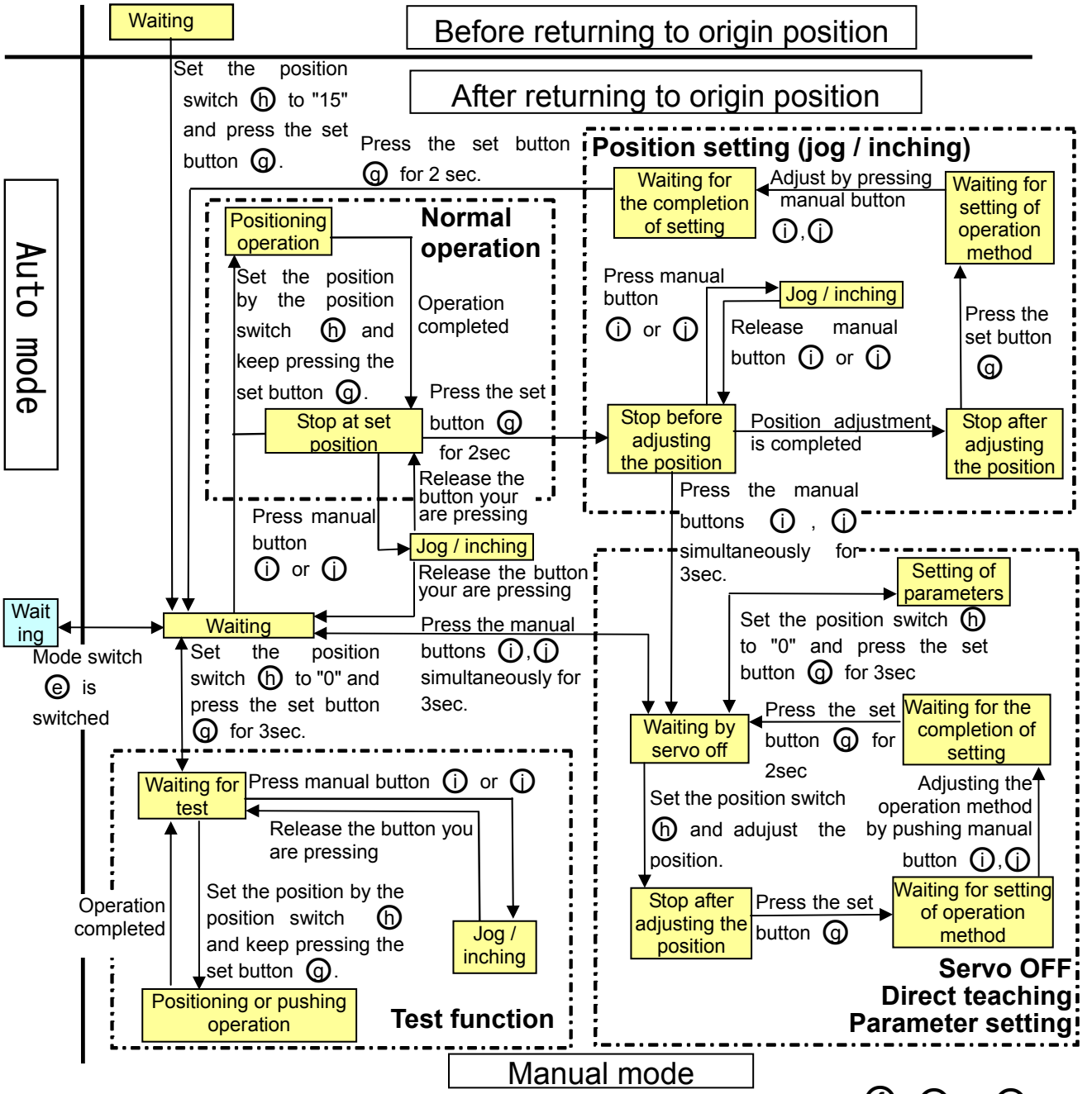
(3)When no operation is made for 3 min. for all buttons and switches, operation reverts back to normal mode.

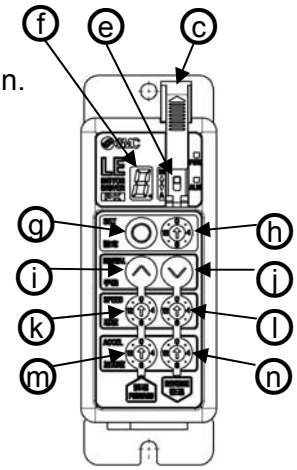
⚠ Caution

- In auto mode, changing the speed, acceleration switch values which are set by ⓚ to ⓝ do not take effect except during the speed adjustment status. If returning to auto mode after changing to manual mode, the value of the switch affects the operation.
- Close the cover c after the switching of the mode to avoid unexpected mode change.

(C) Manual mode after retuning to origin position

The status of the manual mode after return to origin position is shown below. In manual mode, return to origin is controlled by the operation of the controller buttons and switches. The speed and acceleration can be adjusted any time. It is also possible to set the position and operation method. Pushing operation is available during test function.


Waiting
Before returning to origin position
After returning to origin position
Auto mode
Set the position switch ⓗ to "15" and press the set button ⓖ.
Press the set button ⓖ for 2 sec.
Position setting (jog / inching)
Waiting for the completion of setting
Adjust by pressing manual button ⓘ,ⓙ
Waiting for setting of operation method
Positioning operation
Normal operation
Set the position by the position switch ⓗ and keep pressing the set button ⓖ.
Operation completed
Press manual button ⓘ or ⓙ
Jog / inching
Release manual button ⓘ or ⓙ
Press the set button ⓖ
Stop at set position
Press the set button ⓖ for 2sec
Release the button your are pressing
Stop before adjusting the position
Position adjustment is completed
Stop after adjusting the position
Press manual button ⓘ or ⓙ
Jog / inching
Release the button your are pressing
Press the manual buttons ⓘ , ⓙ simultaneously for 3sec.
Setting of parameters
Set the position switch ⓗ to "0" and press the set button ⓖ for 3sec
Wait ing
Mode switch ⓔ is switched
Waiting
Set the position switch ⓗ to "0" and press the set button ⓖ for 3sec.
Press the manual buttons ⓘ,ⓙ simultaneously for 3sec.
Waiting by servo off
Press the set button ⓖ for 2sec
Waiting for the completion of setting
Waiting for test
Press manual button ⓘ or ⓙ
Release the button you are pressing
Set the position switch ⓗ and adujust the position.
Adjusting the operation method by pushing manual button ⓘ,ⓙ
Operation completed
Set the position by the position switch ⓗ and keep pressing the set button ⓖ.
Jog / inching
Stop after adjusting the position
Press the set button ⓖ
Waiting for setting of operation method
Positioning or pushing operation
Test function
Servo OFF
Direct teaching
Parameter setting
Manual mode



Refer to **7.4 Test function (P.38)** for details of normal operation and test function.
Refer to **8.5 Servo ON (P.43)** for turning off of servo.
Refer to **7.2 Setting parameters (P.31)** for details.
Refer to **8.4 Jog / inching operation (P.42)** for jog and inching.

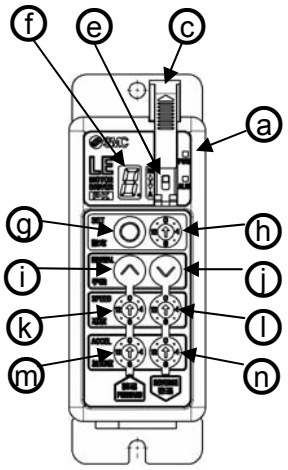
⚠ Caution

Close the cover ⓒ after the switching of the mode to avoid unexpected mode change.

7.4 Test function

The table below shows the difference between normal operation and test function in manual mode. To start the test function, set the position switch ⓗ to "0" while the power LED ⓐ is on (= servo ON) in manual mode and the actuator stops, and press the set button ⓖ for 3sec. When test function starts, the dot on the lower right of the 7-segment LED ⓕ will light up.

	Normal operation	Test function
Availability of pushing operation	X	O
Operation by parallel I/O input	X	X
Output to parallel I/O	X	O
7-segment LED ⓕ display	Without dot Target position setting: Quick flashing During operation: Slow flashing Reached the target position: Lights up	With dot Target position setting: Quick flashing During operation: Slow flashing Reached the target position: Lights up
Adjustment of the speed / acceleration	O	O
Operation method using buttons	Moves towards the target position only while the set button ⓖ is pressed.	Moves towards the target position when the set button ⓖ is pressed. (Not necessary to keep pressing the button)



8. Operations

8.1 Returning to origin position

When the power is supplied, it is necessary to return to origin for positioning or pushing of the actuator. (To ensure the position of origin)

■Input of the return to origin position

There are 2 ways for returning to origin per mode,

Manual mode : Set the position switch ⓗ at "15" and press the set button ⓖ.

Auto mode : Turn on I/O IN0 to IN3 simultaneously.

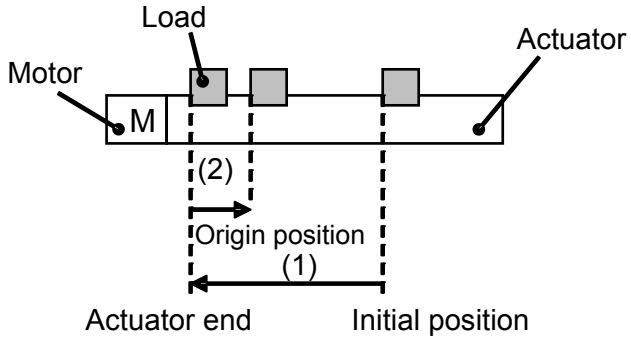
■ Returning to origin position

The actuator travels to the origin position from the initial position when the power was supplied. (Origin position depends on the actuator)・・・ "(1)" in the figure below.

The controller recognizes the actuator end when the slider travels to the actuator end and stops for specific time. Then, the actuator travels to the opposite to the origin with low speed. The position after the travel ("(2)" of the figure below) becomes the origin.

Return to origin input → Travels in origin position → Stop traveling → Reverse → Origin position

(Ex) Returning to origin position



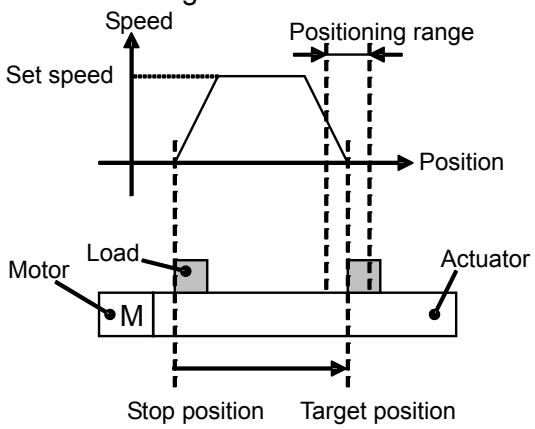
⚠ Caution

The direction of return to home depends on the actuator. Refer to **10. Initial setting value per actuator (P.48)** for the default setting of the return to origin position.

8.2 Positioning

The actuator travels to the target position at speed and acceleration which are set per operating direction. Operation complete signal is output when the actuator reaches the positioning range of the target position.

Ex. Positioning



*The speed wave in the chart above is simplified.

8.3 Pushing operation

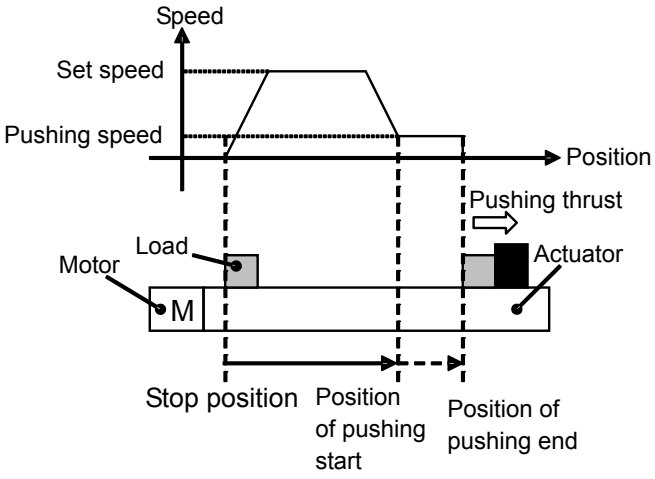
Perform pushing by the set speed and acceleration with the same procedure of positioning. Start pushing from the positioning range. Pushing is the operation in which the actuator travels from the start position of travel to the actuator end of the opposite side with low pushing force with set pushing thrust or less.

⚠ Caution

- ●At manual mode, positioning is performed even if pushing is set. (Except during test function)
- ● Pushing operation may not be possible depending on the actuator. Refer to **10. Initial setting value per actuator (P.48)**.

(1) Successful pushing operation

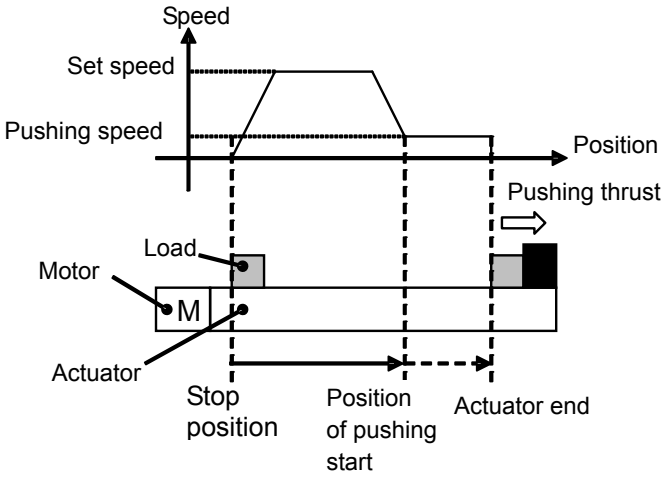
Signal to indicate the operation completion is output when the thrust is more than set pushing force for specific period of time. Set thrust maintains to be generated even after the pushing is completed.



* The speed wave in the chart on the left is simplified.

(2) Unsuccessful pushing operation (Idling)

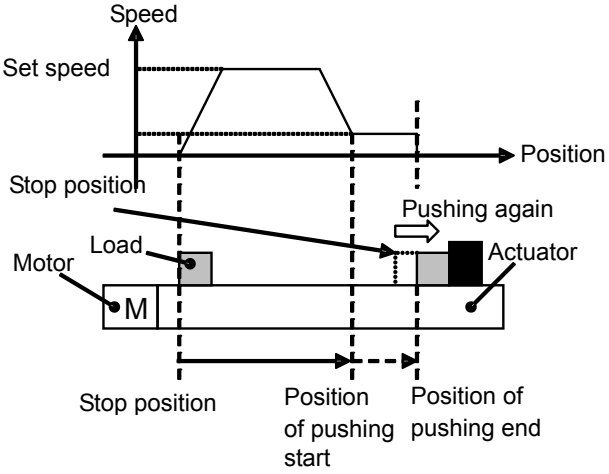
If pushing is not completed when the actautor moves from the start position until the actuator's end, it is pushed back at the actuator end and the completion signal is generated.



* The velocity wave form in the chart on the left is simplified.

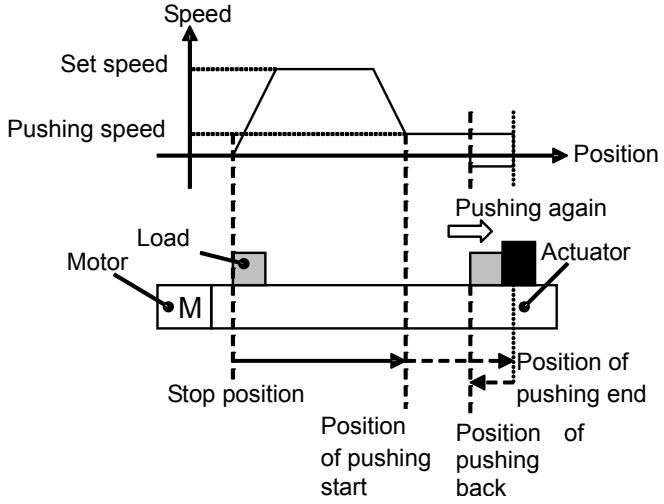
(3) Workpiece moves when pushing operation is completed

(i) When the actuator is in a pushing move and the pushing force is greater than the reaction force, the actuator will continue to move to the end of stroke and then output a signal.



(ii) The workpiece moves toward the opposite of the pushing direction (The reaction force of the workpiece is too large and the actuator is pushed back)

When the actuator is pushed back after the pushing move is completed the actuator is pushed until the reaction force and pushing force are balanced in the direction that the pushing started. (Completion signal stays ON) An alarm is generated when the actuator is pushed back farther than the start position of pushing. (Pushing failure)



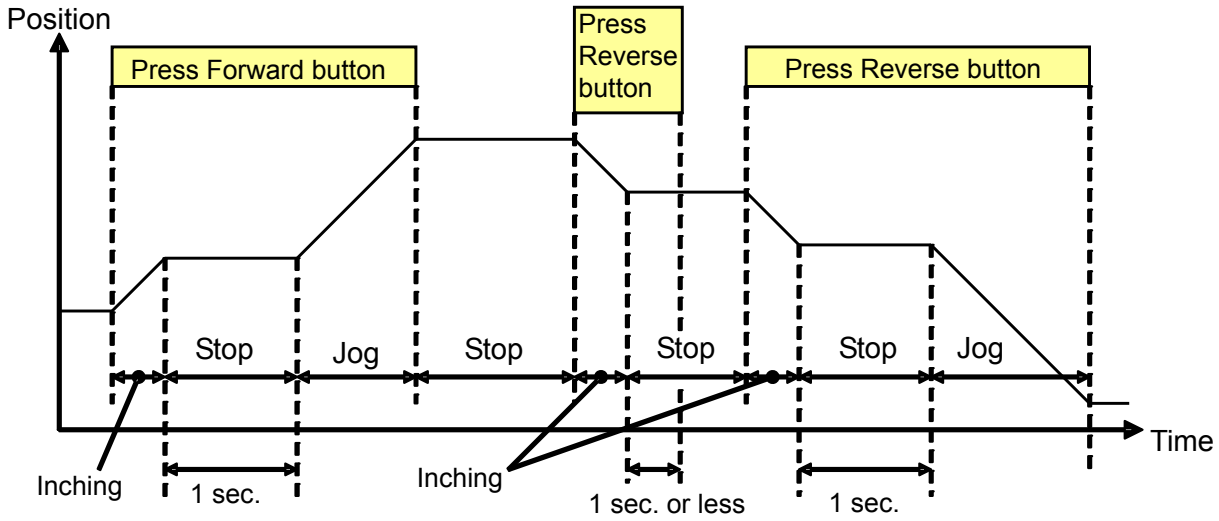
* The speed wave in the chart on the left is simplified.

8.4 Jog / inching operation

Jog / inching is available by pressing forward button ⓘ or reverse button ⓙ at manual mode. Jog / inching can be performed before retuning to origin.

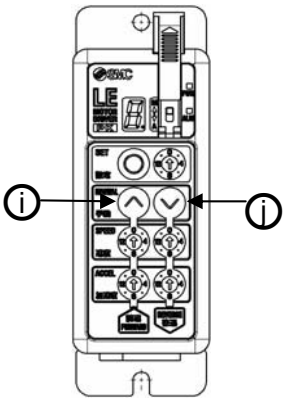
Operation method

Inching starts and stops by pressing forward button ⓘ or reverse button ⓙ. If you keep pressing the button for 1sec. or longer after inching, jog operation starts. Jog operation stops when the button is released.



⚠ Caution

- The travel amount of inching and jog speed depend on actuators. Refer to **10. Initial setting value per actuator (P.48)**.
- The travel amount of inching and jog speed can be changed. Refer to **7.2 Setting parameters (P.31)** for details.

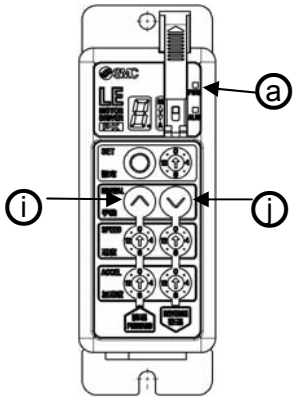


8.5 Servo ON

Servo ON signal is not assigned to the parallel I/O of this controller. The power supply LED ⓐ changes flashing to lighting after specific period of time after power supply and the servo turns on.

The table below shows conditions for servo OFF

	Conditions for servo OFF	Indication of servo OFF
Manual mode	Alarm is generated, or servo OFF by pressing Forward button ⓘ and Reverse button ⓙ simultaneously for 3sec.	Power supply LED ⓐ: Flashing Alarm: OFF
Auto mode	Alarm is generated, or servo OFF by inputting I/O STOP signal.	Power supply LED ⓐ: Flashing



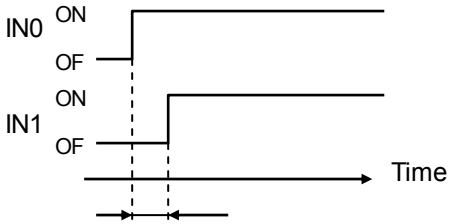
8.6 Response time for the controller input signal

Response delay due to the controller input signal contains following factors.

(1)Controller input signal scan delay
(2)Delay due to input signal analysis
(3)Delay of command analysis

Process delay of PLC or scanning delay of the controller may occur. Keep the input signal combination for 15ms or longer (the recommendation is 30ms). Initialize the input signal conditioning the response signal to the input signal.

When one command is made by inputting several I/O simultaneously, time difference between signals has to be 3ms or less. If the time difference is longer than 3ms, it is recognized as another signal and start the operation. For example, when IN0 and IN1 are commanded to move to ON(position number 3) simultaneously and the time difference between them is large, only the first command is recognized (Only IN0 input is recognized).

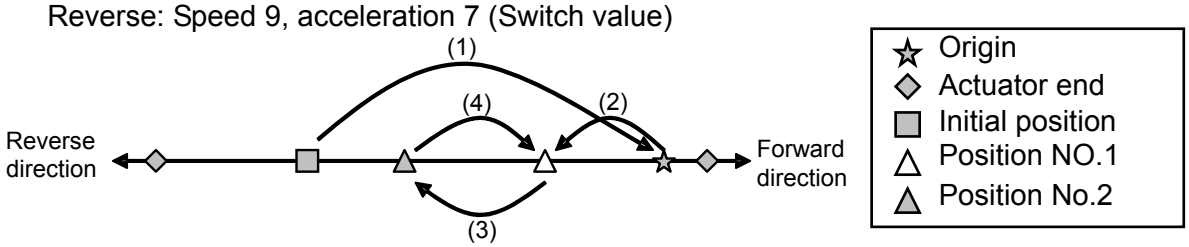


If the time difference is large, only IN0 input is recognized.

9. Operation (Example)

9.1 Positioning / Return to origin position

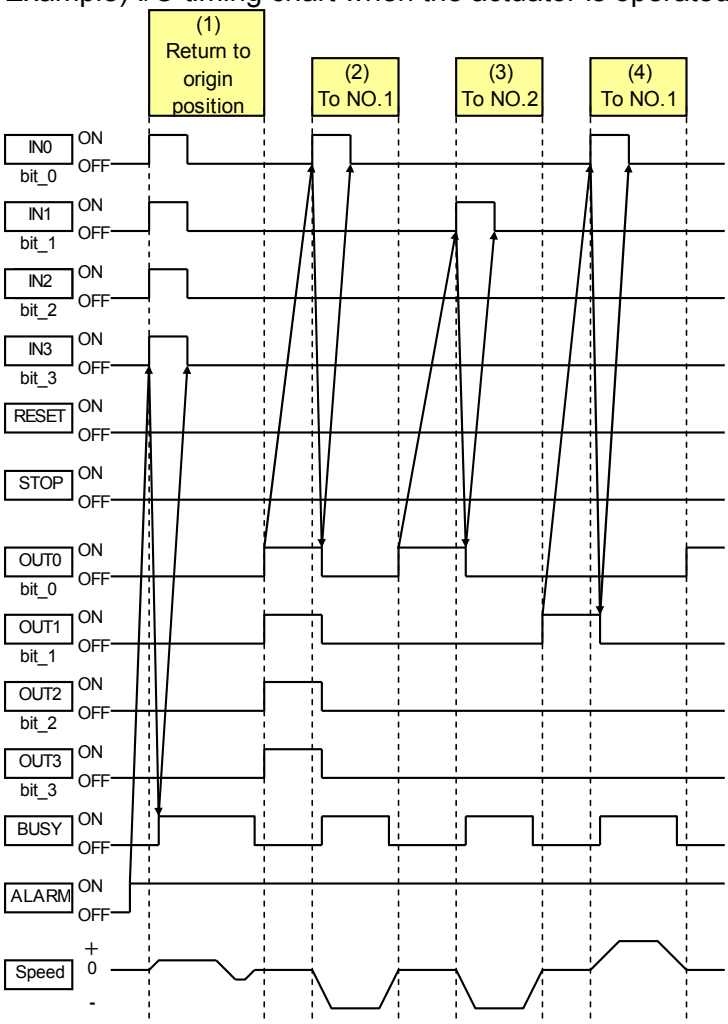
Ex). If the operation pattern is Return to origin --> Position 1 --> Position 2 --> Position 1,
Forward: Speed 5, acceleration 3 (Switch value)
Reverse: Speed 9, acceleration 7 (Switch value)



	Start position	End position	Operating direction	speed	acceleration	Operation method
(1)	Undecided	Origin position	Forward	Fixed	Fixed	Return to origin position
(2)	Origin position	NO.1	Reverse	9	7	Positioning
(3)	NO.1	NO.2	Reverse	9	7	Positioning
(4)	NO.2	NO.1	Forward	5	3	Positioning

* Even for the same position number 1, the travel speed and the acceleration may vary due to the operating direction.

Example) I/O timing chart when the actuator is operated by PLC. Please translate the boxes



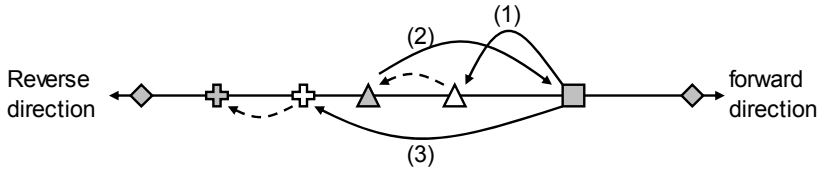
<Procedure>
[1] The servo turns on after supplying the power, and the ALARM turns on.
[2] Confirming that the ALARM turned on, turn on IN0 to 3 to perform (1)Return to origin.
[3] When return to origin starts, BUSY turns on.
[4] Turn OFF IN0 to 3 after confirming BUSY is ON.
[5] BUSY turns OFF when return to origin is completed. OUT0 to 3 turns ON.
[6] When OUT0 to 3 turn ON, turn on IN0, and start operation to the position no,1.
[7] BUSY turns ON when the operation starts, and OUT0 to 3 turn OFF.
[8] When BUSY turns ON, turn OFF IN0.
[9] BUSY turns OFF when the operation is completed, and OUT0 turns OFF.
[10] Do the same for the travel for position No.2 and position No.1.

9.2 Pushing operation

Ex.) If the operation pattern is Position 3 --> Position 4 --> Position 3 --> Position 5.

Forward: Speed 5, acceleration 3 (Switch value)

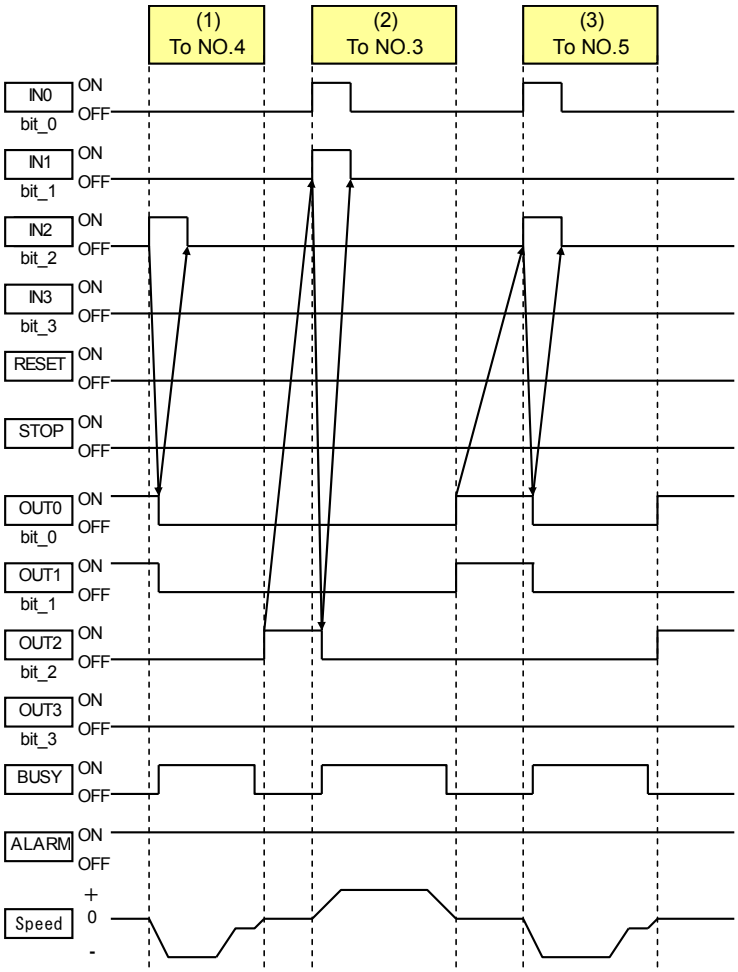
Reverse: Speed 9, acceleration 7 (Switch value



- Actuator end
- Position NO.3
- Position NO.4
- Position at which pushing to the reverse direction from position No.4 is completed
- Position NO.5
- Position at which pushing to the reverse direction from position No.5 is completed

	Start position	End position	Operating direction	speed	acceleration	Operation method
(1)	NO.3	NO.4	Reverse	9	7	Pushing
(2)	NO.4	NO.3	Forward	5	3	Positioning
(3)	NO.3	NO.5	Reverse	9	7	Pushing

Example) I/O timing chart when the actuator is operated by PLC



<Procedure>

[1] When OUT0 and 1 turn on, turn ON IN2 and start operation(1) to position No.4.

[2] BUSY turns ON when the operation starts, and OUT0 and 1 turn OFF.

[3] When BUSY turns ON, turn OFF IN2.

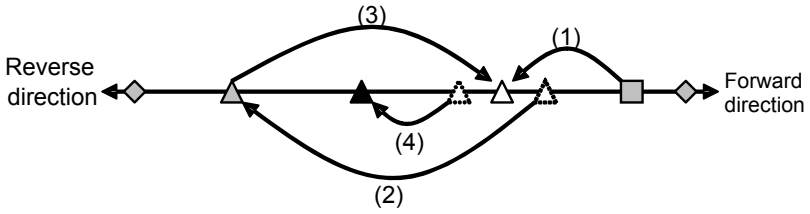
[4] BUSY turns OFF when the operation is completed, and OUT2 turns ON.

[5] Do the same for the travel for position No.3 and position No.5.

9.3 Stoppage during operation

Ex.) Position No.6 -> Stop by inputting the RESET signal while the actuator is traveling to position No.7 -> Position No.8 -> Stop by inputting the STOP signal while the actuator is traveling to position No.7 -> Position No.9

Forward: Speed 5, acceleration 3 (Switch value)
Reverse : Speed 9, acceleration 7 (Switch value)

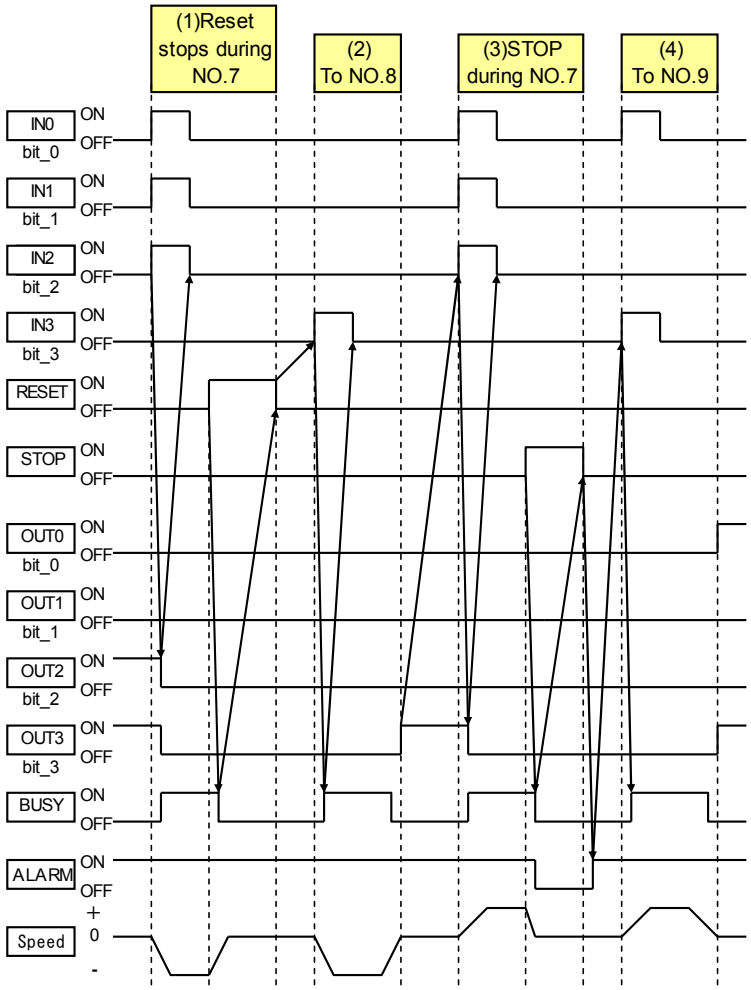


- Actuator end
- Position NO.6
- Position NO.7
- Position at which stops during traveling to position No.7
- Position No.8
- Position No.9

	Start position	End position	Operating direction	speed	acceleration	Operation method
(1)	NO.6	NO.7	Reverse	9	7	Positioning
(2)	-	NO.8	Reverse	9	7	Positioning
(3)	NO.8	NO.7	Forward	5	3	Positioning
(4)	NO.7	NO.9	Reverse	9	7	Positioning

* Even for the same position number 7, the travel speed and the acceleration may vary due to the operating direction.

Example) I/O timing chart when the actuator is operated by PLC.



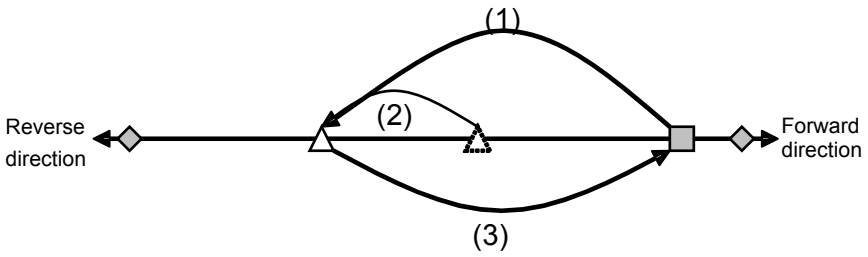
<Procedure>
[1] When OUT2 and 3 turn on, turn ON IN0 to 2 and start operation(1) to position No.7.
[2] BUSY turns ON when the operation starts, and OUT0 and 1 turn OFF.
[3] When BUSY turns ON, turn OFF IN2.
[4] Input RESET during operation
[5] Stops by reducing speed. BUSY turns OFF.
[6] When BUSY turns OFF, turn OFF RESET.
[7] Turn ON IN3 to start travel to position No.8.
[8] When the operation starts, BUSY turns on.
[9] When BUSY turns ON, turn OFF IN3.
[10] BUSY turns OFF when the operation is completed, and OUT3 turns ON.
[11] When OUT3 turns on, turn ON IN0 to 2 and start operation(3) to position No.7.
[12] BUSY turns ON when the operation starts, and OUT3 turns OFF.
[13] Input STOP during operation
[14] Speed is reduced to stop. Servo is turned off. BUSY and ALARM turn OFF.
[15] When BUSY and ALARM turn OFF, turn OFF STOP.
[16] Servo turns on, then ALARM turns ON.
[17] When ALARM turns on, turn ON IN0 and 3 and start operation to position No.9.

9.4 Generation and deactivation of alarm

Ex.) Position No.10→Alarm generated during the travel to Position No. 11→Troubleshoot, deactivate the alarm→Travels to position No.11→Travels to Position No.10

Forward: Speed 5, acceleration 3 (Switch value)

Reverse: Speed 9, acceleration 7 (Switch value)



◇ Actuator end

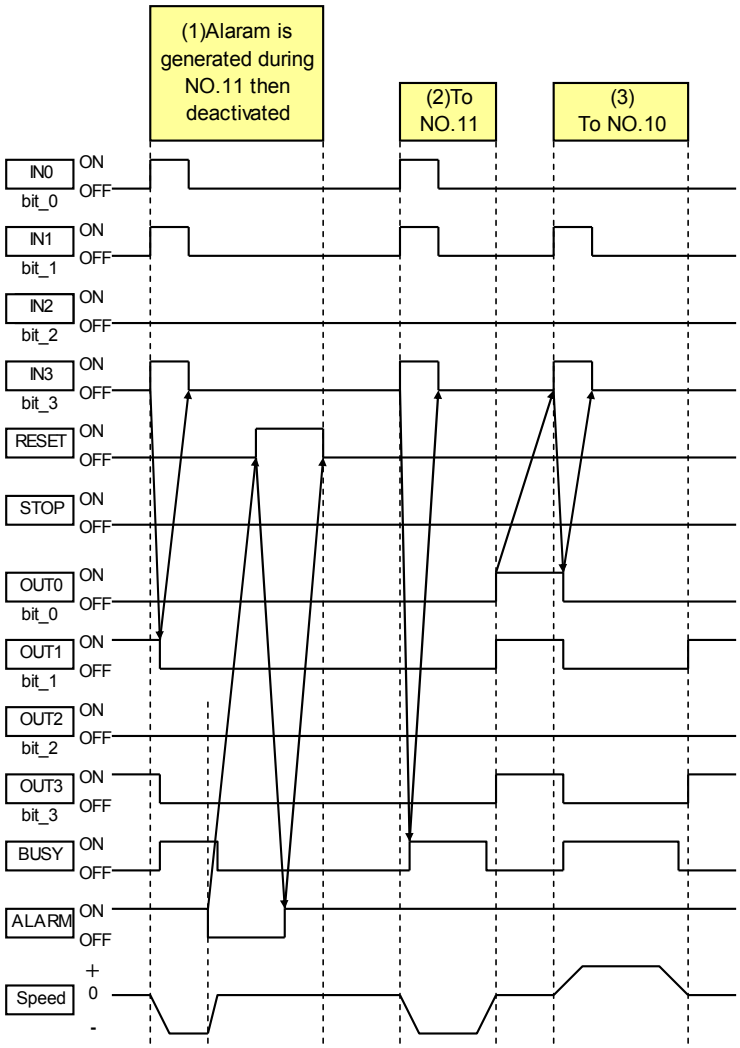
□ Position No.10

△ Position No.11

△ Position at which alarm was generated during travelling to position No.11

	Start position	End position	Operating direction	speed	acceleration	Operation method
(1)	NO.10	NO.11	Reverse	9	7	Positioning
(2)	-	NO.11	Reverse	9	7	Positioning
(3)	NO.11	NO.10	Forward	5	3	Positioning

Example) I/O timing chart when the actuator is operated by PLC.



<Procedure>

[1] When OUT1 and 3 turn on, turn ON IN0, 1, 3 and start operation(1) to position No.11.

[2] BUSY turns ON when the operation starts, and OUT1 and 3 turn OFF.

[3] When BUSY turns ON, turn OFF IN3.

[4] Alarm is generated during the operation, and ALARM and BUSY turn OFF, then stop.

[5] Turn ON RESET after troubleshooting the alarm.

[6] Alarm is deactivated. ALARM is turned OFF.

[7] When ALARM turns OFF, turn OFF RESET.

[8] Turn ON IN0, 1, 3. Then, start the operation(2) to position No.11.

[9] When the operation starts, BUSY turns on.

[10] When BUSY turns ON, turn OFF IN3.

[11] BUSY turns OFF when the operation is completed, and OUT0, 1, 3 turn ON.

[12] When OUT0, 1, 3 turn ON, turn on IN1, 3 and start operation to the position no. 10.

[13] BUSY turns ON when the operation starts, and OUT0, 1 and 3 turn OFF.

[14] When BUSY turns ON, turn OFF IN1, 3.

[15] BUSY turns OFF when the operation is completed, and OUT1, and 3 turn ON.

10. Initial setting value per actuator

10.1 Initial setting value of LEF series

Initial setting value of LEF series

Refer to the table below for the initial setting of the Return to origin, jog and inching.

		LEFB	LEFS							
		16,25,32 common	16A	16B	25A	25B	32A	32B	40A	40B
Return to origin	Direction	Side of the motor								
	Speed [mm/s]	60	30							
	Acceleration [mm/s^2]	1000								
Jog	Speed [mm/s]	48	10	5	12	6	16	8	20	10
	Acceleration [mm/s^2]	1000								
Inching	Distance [mm]	5	1							

Pushing is not available for LEF series. Even if pushing is set on the the 7-segment LED ⓕ of the controller, it becomes positioning.

Refer to the table below for the speed and the acceleration table of the LEFB series.

	LEFB16		LEFB25		LEFB32	
	Speed [mm/s]	Acceleration [mm/s^2]	Speed [mm/s]	Acceleration [mm/s^2]	Speed [mm/s]	Acceleration [mm/s^2]
0	48	200	48	200	48	200
1	60	300	60	300	60	300
2	70	400	70	400	70	400
3	80	500	80	500	80	500
4	100	600	100	600	100	600
5	150	700	200	700	200	700
6	200	800	300	800	300	800
7	300	900	400	900	400	900
8	400	1000	500	1000	500	1000
9	500	1200	600	1200	600	1200
10	600	1400	700	1400	700	1400
11	700	1600	800	1600	800	1600
12	800	1800	900	1800	900	1800
13	900	2000	1000	2000	1000	2000
14	1000	2500	1200	2500	1200	2500
15	1100	3000	1400	3000	1500	3000

Refer to the table below for the speed and the acceleration table of the LEFS series.

	LEFS16A		LEFS16B		LEFS25A		LEFS25B	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	10	200	5	200	12	200	6	200
1	20	300	10	300	20	300	10	300
2	30	400	15	400	30	400	15	400
3	40	500	20	500	40	500	20	500
4	50	600	25	600	50	600	25	600
5	60	700	30	700	60	700	30	700
6	80	800	40	800	80	800	40	800
7	100	900	50	900	100	900	50	900
8	150	1000	75	1000	150	1000	75	1000
9	200	1200	100	1200	200	1200	100	1200
10	250	1400	125	1400	250	1400	125	1400
11	300	1600	150	1600	300	1600	150	1600
12	350	1800	175	1800	350	1800	175	1800
13	400	2000	200	2000	400	2000	200	2000
14	450	2500	225	2500	450	2500	225	2500
15	500	3000	250	3000	500	3000	250	3000

	LEFS32A		LEFS32B		LEFS40A		LEFS40B	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	16	200	8	200	20	200	10	200
1	20	300	10	300	25	300	12	300
2	30	400	15	400	30	400	15	400
3	40	500	20	500	40	500	20	500
4	50	600	25	600	50	600	25	600
5	60	700	30	700	60	700	30	700
6	80	800	40	800	80	800	40	800
7	100	900	50	900	100	900	50	900
8	150	1000	75	1000	150	1000	75	1000
9	200	1200	100	1200	200	1200	100	1200
10	250	1400	125	1400	250	1400	125	1400
11	300	1600	150	1600	300	1600	150	1600
12	350	1800	175	1800	350	1800	175	1800
13	400	2000	200	2000	400	2000	200	2000
14	450	2500	225	2500	450	2500	225	2500
15	500	3000	250	3000	500	3000	250	3000

10.2 Initial setting value of LEH series

Initial setting value of LEF series

Refer to the table below for the initial setting of Return to origin, jog and inching.

		Common with LEHF series	Common with LEH(S, Z) series
Return to origin	Direction	Side to be closed (Clamped side)	
	speed [mm/s]	10	
	acceleration [mm/s^2]	2000	
Jog	speed [mm/s]	10	
	acceleration [mm/s^2]	1000	
Inching	Distnace[mm]	5	1

Refer to the table below for the set value for 3 levels of pushing force of LEHF series. Pushing force is fixed to 5mm/s.

		LEHF10	LEHF20	LEHF32	LEHF40
Pushing force [N]	Low	3	11	48	72
	Middle	5	19.5	84	126
	High	7	28	120	180

*Pushing force accuracy--> LEHS10:±30%F.S., LEHS20:±25%F.S., LEHS32,40: ±20%F.S. Refer to the operation manual of the actuator for details.

Refer to the table below for the set value for 3 levels of pushing force of the LEHZ series. Pushing speed is fixed to 5mm/s.

		LEHS10		LEHS20		LEHS 32	LEHS 40
		Basic	Compact	Basic	Compact		
Pushing force [N]	Low	2.2	1.4	9	7	36	52
	Middle	3.9	2.5	15.5	12	63	91
	High	5.5	3.5	22	17	90	130

*Pushing force accuracy--> LEHS10:±30%F.S., LEHS20:±25%F.S., LEHS32,40: ±20%F.S. Refer to the operation manual of the actuator for details.

Refer to the table below for the set value for 3 levels of pushing force of the LEHZ series. Pushing speed is fixed to 5mm/s.

		LEHZ10		LEHZ16		LEHZ20、25		LEHZ 32	LEHZ 40
		Basic	Compact	Basic	Compact	Basic	Compact		
Pushing force [N]	Low	6	2(3)	6	3(4)	16	11	52	84
	Middle	10	4	10	5.5	28	19.5	91	147
	High	14	6	14	8	40	28	130	210

*Pushing force accuracy--> LEHZ10, 16:±30%F.S., LEHZ20, 25:±25%F.S., LEHZ32,40: ±20%F.S. Refer to the operation manual of the actuator for details.

*The value in bracket ( ) indicates dust cover type (LEHZJ series). The value without ( ) is common value.

Refer to the table below for the speed / acceleration of LEHF series.

	LEHF10		LEHF20		LEHF32		LEHF40	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	5	100	5	100	5	100	5	100
1	10	150	10	150	10	150	10	150
2	15	200	15	200	15	200	15	200
3	20	300	20	300	20	300	20	300
4	25	400	25	400	25	400	25	400
5	30	500	30	500	30	500	30	500
6	35	600	35	600	35	600	35	600
7	40	700	40	700	40	700	40	700
8	45	800	45	800	45	800	45	800
9	50	900	50	900	50	900	50	900
10	55	1000	55	1000	55	1000	55	1000
11	60	1200	60	1200	60	1200	60	1200
12	65	1400	70	1400	70	1400	70	1400
13	70	1600	80	1600	80	1600	80	1600
14	75	1800	90	1800	90	1800	90	1800
15	80	2000	100	2000	100	2000	100	2000

Refer to the table below for the speed / acceleration of LEHS series.

	LEHS10		LEHS20		LEHS32		LEHS40	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	5	100	5	100	5	100	5	100
1	7	150	10	150	10	150	10	150
2	10	200	15	200	15	200	15	200
3	12	300	20	300	20	300	20	300
4	15	400	25	400	25	400	25	400
5	20	500	30	500	30	500	30	500
6	25	600	35	600	35	600	35	600
7	30	700	40	700	40	700	40	700
8	35	800	45	800	45	800	50	800
9	40	900	50	900	50	900	60	900
10	45	1000	55	1000	55	1000	70	1000
11	50	1200	60	1200	60	1200	80	1200
12	55	1400	65	1400	70	1400	90	1400
13	60	1600	70	1600	80	1600	100	1600
14	65	1800	75	1800	90	1800	110	1800
15	70	2000	80	2000	100	2000	120	2000

Refer to the table below for the speed / acceleration of LEHZ series.

	LEHZ10		LEHZ16		LEHZ20		LEHZ25	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	5	100	5	100	5	100	5	100
1	10	150	10	150	10	150	10	150
2	15	200	15	200	15	200	15	200
3	20	300	20	300	20	300	20	300
4	25	400	25	400	25	400	25	400
5	30	500	30	500	30	500	30	500
6	35	600	35	600	35	600	35	600
7	40	700	40	700	40	700	40	700
8	45	800	45	800	45	800	45	800
9	50	900	50	900	50	900	50	900
10	55	1000	55	1000	55	1000	55	1000
11	60	1200	60	1200	60	1200	60	1200
12	65	1400	65	1400	70	1400	70	1400
13	70	1600	70	1600	80	1600	80	1600
14	75	1800	75	1800	90	1800	90	1800
15	80	2000	80	2000	100	2000	100	2000

	LEHZ32		LEHZ40	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	5	100	5	100
1	10	150	10	150
2	15	200	15	200
3	20	300	20	300
4	25	400	25	400
5	30	500	30	500
6	35	600	35	600
7	40	700	40	700
8	50	800	50	800
9	60	900	60	900
10	70	1000	70	1000
11	80	1200	80	1200
12	90	1400	90	1400
13	100	1600	100	1600
14	110	1800	110	1800
15	120	2000	120	2000

10.3 Initial setting value of LES series

Initial setting value of LES series

Refer to the table below for initial setting of Return to origin, jog and inching.

		Common for all series of LES
Return to origin	Direction	Side to be retracted
	speed [mm/s]	20
	acceleration [mm/s^2]	100
Jog	speed [mm/s]	20
	acceleration [mm/s^2]	500
Inching	Distance[mm]	1

Refer to the table below for the set value for 3 levels of pushing force. Pushing speed is fixed to 20mm/s for LESH□□, 10mm/s for LESH□□

		LESH8R		LESH16R		LESH25R	
		J	K	J	K	J	K
Pushing force [N]	Low	4	6	15	23.5	43	77
	Middle	7	10.5	25	39	71.5	128.5
	High	10	15	35	55	100	180

*Pushing force accuracy is ±20%F.S. Refer to the operation manual of the actuator for details.

Refer to the table below for the speed and the acceleration table of the LES series.

	LESH8,16RJ		LESH8,16RK		LESH25RJ		LESH25RK	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	20	300	10	300	20	300	10	300
1	25	400	13	400	25	400	15	400
2	30	500	15	500	30	500	20	500
3	40	600	20	600	40	600	30	600
4	50	700	25	700	50	700	40	700
5	60	800	30	800	60	800	50	800
6	70	900	35	900	70	900	60	900
7	80	1000	40	1000	80	1000	70	1000
8	90	1500	45	1500	90	1500	80	1500
9	100	2000	50	2000	100	2000	90	2000
10	150	2500	75	2500	150	2500	100	2500
11	200	3000	100	3000	200	3000	110	3000
12	250	3500	125	3500	250	3500	120	3500
13	300	4000	150	4000	300	4000	130	4000
14	350	4500	175	4500	350	4500	140	4500
15	400	5000	200	5000	400	5000	150	5000

10.4 Initial setting value of LEY series

Initial setting value of LEY series.

Refer to the table below for initial setting of Return to origin, jog and inching.

		Common for all series of LEY
Return to home origin	Direction	Side to be retracted
	speed [mm/s]	20
	acceleration [mm/s^2]	1000
Jog	speed [mm/s]	10
	acceleration [mm/s^2]	1000
Inching	Distance[mm]	1

Refer to the table below for the set value for 3 levels of pushing force and the pushing speed. Pushing speed is fixed.

		LEY16			LEY25			LEY32		
		A	B	C	A	B	C	A	B	C
Pushing force [N]	Low	14	27	51	63	126	232	80	156	296
	Middle	26	50.5	96	92.5	182	342	134.5	263	501.5
	High	38	74	141	122	238	452	189	370	707
Pushing speed [mm/s]		15	8	4	18	9	5	24	12	6

*Pushing force accuracy is ±20%F.S. Refer to the operation manual of the actuator for details.

Refer to the table below for the speed and the acceleration table of the LEY series.

	LEY16A		LEY16B		LEY16C	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	15	200	8	200	4	200
1	20	300	10	300	6	300
2	30	400	15	400	8	400
3	40	500	20	500	10	500
4	50	600	25	600	13	600
5	60	700	30	700	15	700
6	80	800	40	800	20	800
7	100	900	50	900	25	900
8	150	1000	75	1000	38	1000
9	200	1200	100	1200	50	1200
10	250	1400	125	1400	63	1400
11	300	1600	150	1600	75	1600
12	350	1800	175	1800	88	1800
13	400	2000	200	2000	100	2000
14	450	2500	225	2500	113	2500
15	500	3000	250	3000	125	3000

	LEY25A		LEY25B		LEY25C	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	18	200	9	200	5	200
1	24	300	12	300	7	300
2	36	400	18	400	9	400
3	48	500	24	500	12	500
4	60	600	30	600	15	600
5	72	700	36	700	18	700
6	84	800	42	800	21	800
7	100	900	50	900	25	900
8	150	1000	75	1000	38	1000
9	200	1200	100	1200	50	1200
10	250	1400	125	1400	63	1400
11	300	1600	150	1600	75	1600
12	350	1800	175	1800	88	1800
13	400	2000	200	2000	100	2000
14	450	2500	225	2500	113	2500
15	500	3000	250	3000	125	3000

	LEY32A		LEY32B		LEY32C	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	24	200	12	200	6	200
1	32	300	16	300	8	300
2	40	400	20	400	10	400
3	48	500	24	500	12	500
4	56	600	28	600	14	600
5	64	700	32	700	16	700
6	80	800	40	800	20	800
7	100	900	50	900	25	900
8	150	1000	75	1000	38	1000
9	200	1200	100	1200	50	1200
10	250	1400	125	1400	63	1400
11	300	1600	150	1600	75	1600
12	350	1800	175	1800	88	1800
13	400	2000	200	2000	100	2000
14	450	2500	225	2500	113	2500
15	500	3000	250	3000	125	3000

10.5 Initial setting value of LER series

Initial setting value of LER series

Refer to the table below for initial setting of Return to origin, jog and inching.

		LER□□□K series	LER□□□J series
Return to origin	Direction	Counterclockwise(CCW)	Counterclockwise(CCW)
	speed [°/s]	20	30
	acceleration [°/s^2]	1000	1000
Jog	speed [°/s]	20	30
	acceleration [°/s^2]	1000	1000
Inching	Distance[°]	5	5

During pushing operation of the LER series, the indication of the 7-segment LED of the controller varies, but the values are the same as the figures below regardless of the 3 levels.

Pushing speed: LER□□□K is 20[°/s] Fixed, LER□□□J is 30[°/s] Fixed.

	LER10		LER30		LER50	
	K	J	K	J	K	J
Pushing torque [N・m]	0.15	0.1	0.6	0.4	5.0	3.3

*Pushing torque accuracy--> LER10□:±30%F.S., LER30□:±25%F.S., LER50□: ±20%F.S.

*Refer to the operation manual of the actuator for details.

Refer to the table below for the speed and the acceleration table.

	LER□□□K		LER□□□J	
	Angular speed [°/s]	Angular acceleration [°/s^2]	Angular speed [°/s]	Angular acceleration [°/s^2]
0	20	200	30	200
1	30	300	50	300
2	40	400	60	400
3	50	500	80	500
4	60	600	100	600
5	70	700	120	700
6	80	800	140	800
7	90	900	160	900
8	100	1000	180	1000
9	110	1200	200	1200
10	130	1400	220	1400
11	150	1600	260	1600
12	170	1800	300	1800
13	200	2000	340	2000
14	230	2500	380	2500
15	280	3000	420	3000

10.6 Initial setting value of LEP series

Initial setting value of LEP (LEPY / LEPS) series.

Refer to the table below for initial setting of Return to origin, jog and inching.

		LEP□□-□J	LEP□□-□K
Return to home origin	Direction	Side to be retracted	
	speed [mm/s]	20	10
	acceleration [mm/s^2]	1000	1000
Jog	speed [mm/s]	20	10
	acceleration [mm/s^2]	1000	1000
Inching	Distance[mm]	1	1

Refer to the table below for the set value for 3 levels of pushing force and the pushing speed. Pushing speed is fixed.

		LEP□6		LEP□10L (Compact)		LEP□10 (Basic)	
		J	K	J	K	J	K
Pushing force [N]	Low	7	14	12	24	12.5	25
	Middle	8.5	17	16	32	19	37.5
	High	10	20	20	40	25	50
Pushing speed [mm/s]		20	10	20	10	20	10

*Pushing force accuracy is ±30%F.S. for the LEP□6 and ±25%F.S. for the LEP□10
Refer to the operation manual of the actuator for details.

Refer to the table below for the speed and the acceleration table of the LEP series.

	LEP□6-□J		LEP□6-□K		LEP□10(L)-□J		LEP□10(L)-□K	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	20	200	10	200	20	200	10	200
1	30	300	15	300	30	300	15	300
2	40	400	20	400	40	400	20	400
3	50	500	30	500	50	500	30	500
4	60	600	40	600	75	600	40	600
5	70	700	50	700	100	700	50	700
6	80	800	60	800	125	800	60	800
7	100	900	70	900	150	900	70	900
8	125	1000	80	1000	175	1000	80	1000
9	150	1200	90	1200	200	1200	90	1200
10	175	1400	100	1400	225	1400	100	1400
11	200	1600	110	1600	250	1600	120	1600
12	225	1800	120	1800	275	1800	140	1800
13	250	2000	130	2000	300	2000	160	2000
14	275	2500	140	2500	325	2500	180	2500
15	300	3000	150	3000	350	3000	200	3000

10.7 Initial setting value of LEL series

Initial setting value of LEL series.

Refer to the table below for initial setting of Return to origin, jog and inching.

		Common for all series of LEL
Return to home origin	Direction	Motor side
	speed [mm/s]	80
	acceleration [mm/s^2]	1000
Jog	speed [mm/s]	100
	acceleration [mm/s^2]	1000
Inching	Distance[mm]	1

Refer to the table below for the speed and the acceleration table of the LEL series.

	LEL25M		LEL25L	
	speed [mm/s]	acceleration [mm/s^2]	speed [mm/s]	acceleration [mm/s^2]
0	50	200	50	200
1	60	300	60	300
2	70	400	70	400
3	80	500	80	500
4	100	600	100	600
5	120	700	150	700
6	140	800	200	800
7	160	900	250	900
8	180	1000	300	1000
9	200	1200	400	1200
10	250	1400	500	1400
11	300	1600	600	1600
12	350	1800	700	1800
13	400	2000	800	2000
14	450	2500	900	2500
15	500	3000	1000	3000

11. Options

11.1 Actuator cable [5m or less]

L E – C P – □ □

Cable length (L)

1	1.5m
3	3m
5	5m

Actuator cable type

Nil	Robot cable
S	Standard cable

①

Signal	TerminalNo.
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

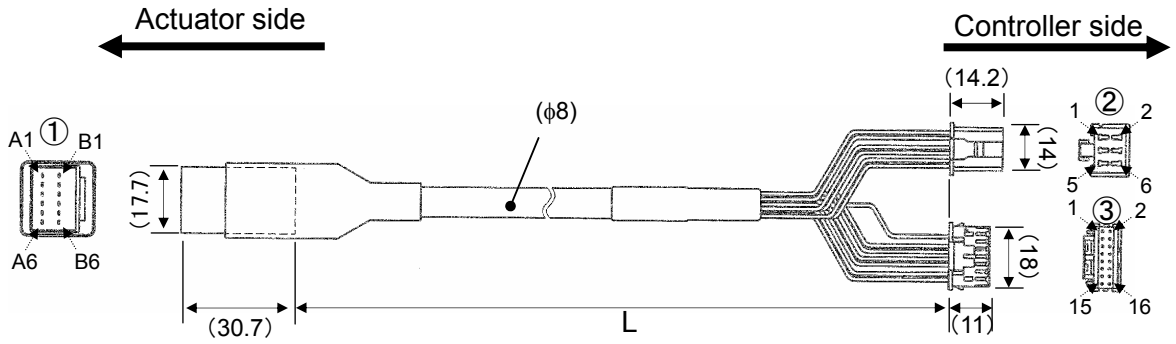
②

Cable color	TerminalNo.
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

③

Cable color	TerminalNo.
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3

Shield



11.2 Actuator cable [8 to 20m]

L E – C P – □

Cable length (L)

8	8m *
A	10m *
B	15m *
C	20m *

* Made to order

* Transporting performance is reduced by the voltage drop of the cable.

* Only "Robotic type cable" can be selected.

①

Signal	TerminalNo.
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
$\overline{A}$	B-5
A	A-5
$\overline{B}$	B-6
B	A-6

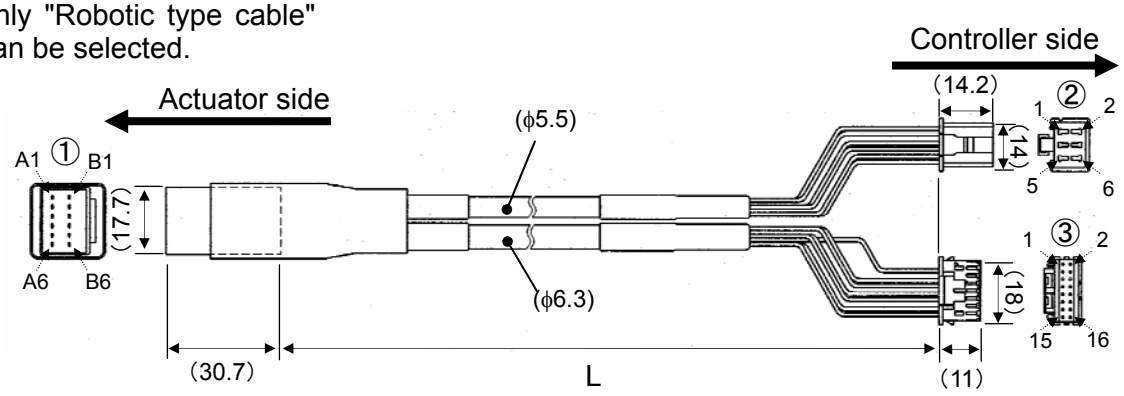
②

Cable color	TerminalNo.
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

③

Cable color	TerminalNo.
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3

Shield



11.3 Actuator cable （for sensor / lock） [5m or less]

L E − C P − □ □ − B

Cable length（L）

1	1.5m
3	3m
5	5m

Actuator cable type

Nil	Robot cable
S	Standard cable

①

Signal	TerminalNo.
A	B-1
$\overline{A}$	A-1
B	B-2
$\overline{B}$	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
A	B-5
$\overline{A}$	A-5
B	B-6
B	A-6

②

Cable color	TerminalNo.
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

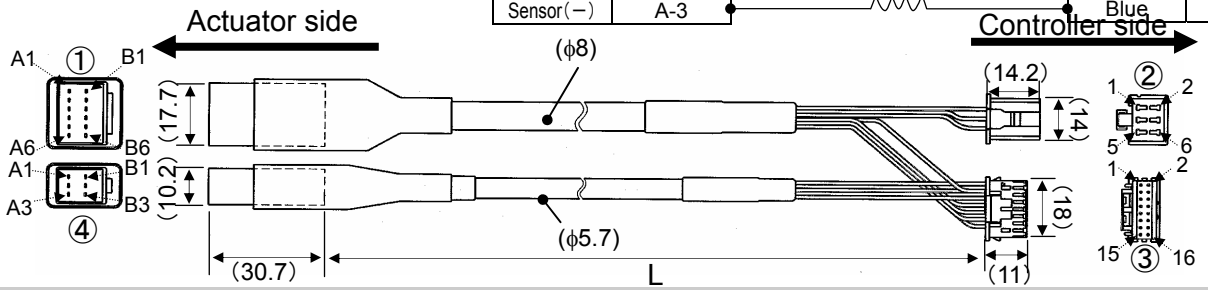
③ Shield

Cable color	TerminalNo.
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3

④

Signal	TerminalNo.
Lock(+)	B-1
Lock(−)	A-1
Sensor(+)	B-3
Sensor(−)	A-3

Red	4
Black	5
Brown	1
Blue	2



11.4 Actuator cable （for sensor / lock） [8 to 20m]

L E − C P − □ − B

Cable length（L）

8	8m *
A	10m *
B	15m *
C	20m *

* Made to order
* Transporting performance is reduced by the voltage drop of the cable.
* Only "Robotic type cable" can be selected.

①

Signal	TerminalNo.
$\overline{A}$	B-1
A	A-1
$\overline{B}$	B-2
B	A-2
COM-A/COM	B-3
COM-B/ -	A-3
Vcc	B-4
GND	A-4
A	B-5
$\overline{A}$	A-5
B	B-6
B	A-6

②

Cable color	TerminalNo.
Brown	2
Red	1
Orange	6
Yellow	5
Green	3
Blue	4

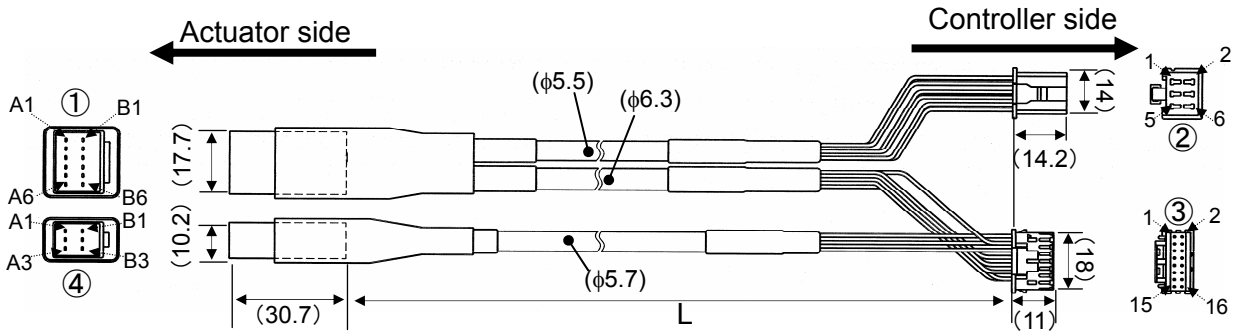
③ Shield

Cable color	TerminalNo.
Brown	12
Black	13
Red	7
Black	6
Orange	9
Black	8
-	3

④

Signal	TerminalNo.
Lock(+)	B-1
Lock(−)	A-1
Sensor(+)	B-3
Sensor(−)	A-3

Red	4
Black	5
Brown	1
Blue	2



12. Alarm detection

Details of the alarm can be checked by the controller LED indication and parallel I/O terminal.
When an alarm is generated, deactivate the alarm by troubleshooting, referring to **12.2 Alarm Content・Countermeasure (P.62)**.

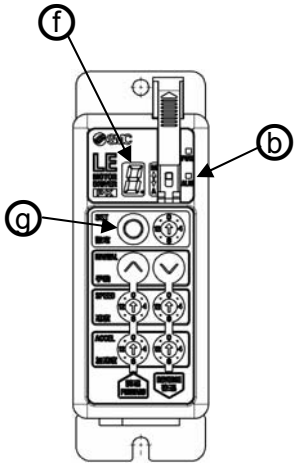
Alarms are divided into two types. One type can be cleared by pressing the set button ⓖ or inputting the RESET I/O signal. The other type cannot be cleared unless the power supply control(C24V) is turned off and on once.

12.1 Alarm group output

Alarms from this controller are output to the LED and the signal is output from I/O so that the alarm type is recognizable. For alarms, LED ⓑ lights up in red and the alarm group is indicated by the 7-segment LED ⓕ. The I/O indicates the presence of an alarm ALARM with OUT0 to 3.

Alarm group	7-segment LED Display	Parallel signal output					How to restart the operation
		ALARM *1, 2	OUT0	OUT1	OUT2	OUT3	
B	b	OFF	OFF	ON	OFF	OFF	Input RESET or set the button ⓖ
C	c	OFF	OFF	OFF	ON	OFF	
D	d	OFF	OFF	OFF	OFF	ON	
E	E	OFF	OFF	OFF	OFF	OFF	Power supply for control is turned off --> Supply again

*1 ALARM is OFF when an alarm is generated 1 because it is a normal closed type.
*2 When the servo is turned OFF, ALARM is turned OFF. The generated alarm cannot be identified only by OUT5.



12.2 Alarm Content・Countermeasure

Group	The condition of the controller when an alarm is generated	How to clear the alarm	Condition / Countermeasure
B	Any condition	Input RESET	**<Condition>** Problem occurred with the controller data or parameters. **<Countermeasure>** If the problem is not solved by supplying power again, contact SMC.
C	During or after pushing operation	Input RESET	**<Condition>** During the pushing operation, the actuator is pushed back beyond the start position of pushing. **<Countermeasure>** Set a larger pushing thrust or reduce the reaction force of the load. Refer to **8.3 Pushing operation (P.40)** for details of pushing operation.
C	Stopped	Input RESET	**<Condition>** This is generated when return to origin, positioning, pushing or a jog operation is commanded when the servo is OFF. **<Countermeasure>** Check if I/O signal STOP is input. Also, check if the servo is OFF in manual mode. Refer to **8.5 Servo ON (P.43)** for turning off the servo.
C	Stopped	Input RESET	**<Condition>** This is generated when positioning, pushing is commanded before return to origin is completed. **<Countermeasure>** Start operation after the completion of the return to origin. Return to origin must be performed after a group D alarm is generated and deactivated.
D	During operation	Input RESET	**<Condition>** Motor rotation exceeds specified value. **<Countermeasure>** If an external force is being applied, remove it. If there is no external force being applied, and the problem is not solved by supplying power again, please contact SMC.

Group	The condition of the controller when an alarm is generated	How to clear the alarm	Condition / Countermeasure
D	During operation	Input RESET	**<Condition>** The power supply voltage for motor which is detected in the controller is out of the specified range. The regenerative electricity of the motor is large while using the brake . **<Countermeasure>** Check the voltage supplied to the power supply for the controller motor (M24V).Check if the operating condition of the actuator is within the specification range. **⚠ Caution** If the power supply is an inrush current suppressor type, a voltage drop may occur during acceleration/deceleration, generating an alarm.
D	Any condition	Input RESET	**<Condition>** Ambient temperature of the power element in the controller is high. **<Countermeasure>** Improve the peripheral environment of the controller after checking the installation of the controller. Refer to **3.4 Mounting (P.13)** for the mounting conditions of the controller.
D	Any condition	Input RESET	**<Condition>** The power supply voltage control which is detected in the controller is out of the specified range. **<Countermeasure>** Check the voltage supplied to the power supply for the controller motor (24VC). **⚠ Caution** When the power supply for the motor and control is shared and the power supply is an inrush current suppressor type, a voltage drop may occur during acceleration/deceleration, generating an alarm.
D	During or after suspension of operation	Input RESET	**<Condition>** When there is a delay to reach the target position longer than the specific value for delay. **<Countermeasure>** Check if the travel of the actuator was interrupted.

Group	The condition of the controller when an alarm is generated	How to clear the alarm	Condition / Countermeasure
E	When the power is supplied	Power supply for control is turned off	**<Condition>** Positioning of the polarity is not finished properly. When the power is supplied, the actuator slightly moves to detect the polarity of the motor. This alarm is generated when the actuator cannot be moved. **<Countermeasure>** Supply power in conditions in which the actuator is operable.
E	When the power is supplied	Power supply for control is turned off	**<Condition>** An abnormality is confirmed with the current sensors which are recognized when the controller is initialized. **<Countermeasure>** Confirm the combination of the controller and the actuator is correct. If the problem is not solved by supplying power again, please contact SMC.
E	During operation	Power supply for control is turned off	**<Condition>** Position deviation counter in the controller has overflowed. **<Countermeasure>** Check if the travel of the actuator is interrupted. Check if the load of the actuator is within the specification range.
E	Any condition	Power supply for control is turned off	**<Condition>** Output current at the power supply circuit is abnormally high. **<Countermeasure>** Check if the actuator cable or connector is short-circuited. Confirm the combination of the controller and the actuator is correct.
E	Any condition	Power supply for control is turned off	**<Condition>** Abnormality concerning EEPROM is confirmed. **<Countermeasure>** If the problem is not solved by supplying power again, please contact us. （The write limit of the EEPROM is roughly 100,000 times）
E	Any condition	Power supply for control is turned off	**<Condition>** CPU is not operating properly. (Failure of CPU and peripheral circuits, or malfunction due to noise) **<Countermeasure>** If the problem is not solved by supplying power again, please contact SMC.

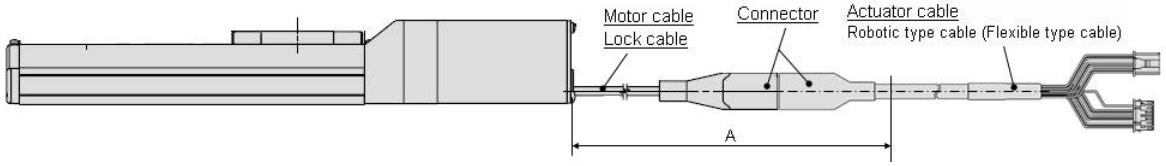
13. Wiring of cables/Common precautions

⚠Warning

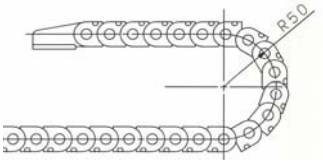
1. **Adjusting, mounting or wiring change should never be done before shutting off the power supply to the product.**
   Electrical shock, malfunction and damaged can result.
2. **Never disassemble the cable. Use only specified cables.**
3. **Never connect or disconnect the cable or connector with power on.**

⚠Caution

1. **Wire the connector securely. Do not apply any voltage to the terminals other than those specified in the product Manual.**
2. **Wire the connector securely.**
   Check for correct connector wiring and polarity.
3. **Take appropriate measures against noise.**
   Noise in a signal line may cause malfunction. As a countermeasure, separate high voltage and low voltage cables, and shorten wiring lengths, etc.
4. **Do not route wires and cables together with power or high voltage cables.**
   The product can malfunction due to interference of noise and surge voltage from power and high voltage cables to the signal line. Route the wires of the product separately from power or high voltage cables.
5. **Take care that actuator movement does not catch cables.**
6. **Operate with cables secured. Avoid bending cables at sharp angles where they enter the product.**
7. **Avoid twisting, folding, rotating or applying an external force to the cable.**
   Risk of electric shock, wire break, contact failure and lost of control for the product can happen.
8. **Fix the cable protruding from the product in place before using.**
   The motor and lock cables are not robotic type cables and can be damaged when moved. Therefore fix the cables and the connectors (part “A” in figure below) when set up.



9. **Select “Robotic type cables” in case of inflecting actuator-cable repeatedly. And do not put cables into a flexible moving tube with a radius smaller than the specified value. (Min. 50mm).**
   Risk of electric shock, wire break, contact failure and loss of control for the product can happen if “Standard cables” are used in case of inflecting the cables repeatedly.



10. **Confirm proper wiring of the product.**
    Poor insulation (interference with other circuits, poor insulation between terminals and etc.) can apply excessive voltage or current to the product causing damage.
11. **The Speed / pushing force may vary, depending on the cable length, load and mounting conditions etc..**
    If the cable length exceeds 5m, the speed / pushing force will be reduced by a maximum of 10% per 5m. (If cable length is 15m: Maximum 20% reduction.)

[Transportation]

⚠Caution

1. **Do not carry or swing the product by the cable**

14. Electric actuators/Common precautions

14.1 Design and selection

⚠Warning

1. **Be sure to read the Operation Manual.**
   Handling or usage/operation other than that specified in the Operation Manual may lead to breakage and operation failure of the product.
   Any damage attributed to the use beyond the specifications is not guaranteed.
2. **There is a possibility of dangerous sudden action by the product if sliding parts of machinery are twisted due to external forces, etc.**
   In such cases, human injury may occur, such as by catching hands or feet in the machinery, or damage to the machinery itself may occur. Design the machinery should be designed to avoid such dangers.
3. **A protective cover is recommended to minimize the risk of personal injury.**
   If a driven object and moving parts of the product are in close proximity, personal injury may occur. Design the system to avoid contact with the human body.
4. **Securely tighten all stationary parts and connected parts so that they will not become loose.**
   When the product operates with high frequency or is installed where there is a lot of vibration, ensure that all parts remain secure.
5. **Consider a possible loss of power source.**
   Take measures to prevent injury and equipment damage even in the case of a power source failure.
6. **Consider behavior of emergency stop of whole system.**
   Design the system so that human injury and/or damage to machinery and equipment will not be caused, when it is stopped by a safety device for abnormal conditions such as a power outage or a manual emergency stop of whole system.
7. **Consider the action when operation is restarted after an emergency stop or abnormal stop of whole system.**
   Design the system so that human injury or equipment damage will not occur upon restart of operation of whole system.
8. **Disassembly and modification prohibited**
   Do not modify or reconstruct (including additional machining) the product. An injury or failure can result.
9. **Do not use parallel input STOP singal as the emergency stop of system.**
   The STOP signal is for decelerating and stopping the actuator.
   Design the system with an emergency stop circuit which is applied relevant safety standard separately.
10. **When using it for vertical application, it is necessary to build in a safety device.**
    The rod may fall due to the weight of work. The safety device should not interfere with normal operation of the machine.

⚠Caution

1. **Operate within the limits of the maximum usable stroke.**
   The product will be damaged if it is used with the stroke which is over the maximum stroke. Refer to the specifications of the product.
2. **When the product repeatedly cycles with partial strokes, operate it at a full stroke at least once every 10 strokes.**
   Otherwise, lubrication can run out.
3. **Do not use the product in applications where excessive external force or impact force is applied to it.**
   The product can be damaged.

4. **Refer to a common auto switch /matter (Best Pneumatics No. 2) when an auto switch is built in and used.**
5. **Return to origin cannot return while operating.**
   It cannot be done during positioning operation, pushing operation and pushing.

14.2 Mounting

⚠Warning

1. **Install and operate the product only after reading the Operation Manual carefully and understanding its contents. Keep the manual in a safe place future reference.**
2. **Observe the tightening torque for screws.**
   Tighten the screws to the recommended torque for mounting the product.
3. **Do not make any alterations to this product.**
   Alterations made to this product may lead to a loss of durability and damage to the product, which can lead to human injury and damage to other equipment and machinery.
4. **When using external guide, the guide axis should be parallel to the actuator axis.**
   There will be damage/excessive wear on the lead screw if the external guide is not parallel.
5. **When an external guide is used, connect the moving parts of the product and the load in such a way that there is no interference at any point within the stroke.**
   Do not scratch or dent the sliding parts of the product tube or piston rod etc., by striking or grasping them with other objects. Components are manufactured to precise tolerances, so that even a slight deformation may cause faulty operation.
6. **Prevent the seizure of rotating parts.**
   Prevent the seizure of rotating parts (pins, etc.) by applying grease.
7. **Do not use the product until you verify that the equipment can be operated properly.**
   After mounting or repair, connect the power supply to the product and perform appropriate functional inspections to check it is mounted properly.
8. **At the overhang mounted impeller fixation**
   There is a possibility that the power at the bending moment damages the actuator when moving it at high speed.
   The support metal fittings that suppress the vibration of the main body of the actuator are installed. Lower and use speed for the state that the actuator doesn't vibrate.
9. **When attaching work piece, do not apply strong impact or large moment.**
   If an external force over the allowable moment is applied, it may cause looseness in the guide unit, an increase in sliding resistance or other problems.
10. **Maintenance space.**
    Allow sufficient space for maintenance and inspection.

14.3 Handling

⚠Warning

1. **Do not touch the motor while in operation.**
   The surface temperature of the motor can increase to approx. 90°C to 100°C due to operating conditions. Energizing alone may also cause this temperature increase. As it may cause burns, do not touch the motor when in operation.
2. **If abnormal heating, smoking or fire, etc., occurs in the product, immediately shut off the power supply.**

3. **Immediately stop operation if abnormal operation noise or vibration occurs.**
   If abnormal operation noise or vibration occurs, the product may have been mounted incorrectly. Unless operation of the product is stopped for inspection, the product can be seriously damaged.
4. **Never touch the rotating part of the motor or moving part of the actuator while in operation.**
5. **When installing, adjusting, inspecting or performing maintenance on the product, controller and related equipment, be sure to shut off the power supply to each of them. Then, lock it so that no one other than the person working can turn the power on, or implement measures such as a safety plug.**
6. **In the case of the actuator that has a servo motor (24VDC), the "motor phase detection step" is done by inputting the servo on signal just after the controller power is turned on. The "motor phase detection step" operates the table/rod to the maximum distance of the lead screw. (The motor rotates in the reverse direction if the table hits an obstacle such as the end stop damper.) Take the "motor phase detection step" into consideration for the installation and operation of this actuator.**

⚠Caution

1. **Keep the controller and product combined as delivered for use.**
   The product is set in parameters for shipment. If it is combined with a different parameter, failure can result.
2. **Check the product for the following points before operation.**
   a) Damage to electric driving line and signal lines
   b) Looseness of the connector to each power line and signal line
   c) Looseness of the actuator/cylinder and controller/driver mounting
   d) Abnormal operation
   e) Emergency stop of the total system
3. **When more than one person is performing work, decide on the procedures, signals, measures and resolution for abnormal conditions before beginning the work. Also, designate a person to supervise work other than those performing work.**
4. **Actual speed of the product will be changed by the workload.**
   Before selecting a product, check the catalog for the instructions regarding selection and specifications.
5. **Do not apply a load, impact or resistance in addition to a transferred load during return to origin.**
   In the case of the return to origin by pushing force, additional force will cause displacement of the origin position since it is based on detected motor torque.
6. **Do not remove the name plate.**
7. **Operation test should be done by low speed. Start operation by predefined speed after confirming there is no trouble.**

[Ground]

⚠Warning

1. **Please give the ground to the actuator.**
2. **The ground should be exclusive use. (Less than 100Ω)**
3. **The ground cable length should be as short as possible.**

[Unpackaging]

⚠Caution

1. **Check the received product is as ordered.**
   If a different product is installed from the one ordered, injury or damage can result.

14.4 Operating environment

⚠Warning

1. **Avoid use in the following environments.**
   a. Locations where a large amount of dusts and cutting chips are airborne.
   b. Locations where the ambient temperature is outside the range of the temperature specification (refer to specifications).
   c. Locations where the ambient humidity is outside the range of the humidity specification (refer to specifications).
   d. Locations where corrosive gas, flammable gas, sea water, water and steam are present.
   e. Locations where strong magnetic or electric fields are generated.
   f. Locations where direct vibration or impact is applied to the product.
   g. Areas that are dusty, or are exposed to splashes of water and oil drops.
   h. Areas exposed to direct sunlight (ultraviolet ray).
2. **Do not use in an environment where the product is directly exposed to liquid, such as cutting oils.**
   If cutting oils, coolant or oil mist contaminates the product, failure or increased sliding resistance can result.
3. **Install a protective cover when the product is used in an environment directly exposed to foreign matters such as dust, cutting chips and spatter.**
   Play or increased sliding resistance can result.
4. **Shade the sunlight in the place where the product is applied with direct sunshine.**
5. **Shield the valve from radiated heat generated by nearby heat sources.**
   When there is a heat source surrounding the product, the radiated heat from the heat source can increase the temperature of the product beyond the operating temperature range. Protect it with a cover, etc.
6. **Grease oil can be decreased due to external environment and operating conditions, and it deteriorates lubrication performance to shorten the life of the product.**

[Storage]

⚠Warning

1. **Do not store the product in a place in direct contact with rain or water drops or is exposed to harmful gas or liquid.**
2. **Store in an area that is shaded from direct sunlight and has a temperature and humidity within the specified range (-10°C to 60°C, 90%RH or less and No condensation or freezing.)**
3. **Do not apply vibration and impact to the product during storage.**

14.5 Maintenance

⚠Warning

1. **Do not disassemble or repair the product.**
   Fire or electric shock can result.
2. **Before modifying or checking the wiring, the voltage should be checked with a tester 5 minutes after the power supply is turned off.**
   Electrical shock can result.

⚠Caution

1. **Maintenance should be performed according to the procedure indicated in the Operating Manual.**
   Incorrect handling can cause injury, damage or malfunction of equipment and machinery.
2. **Removal of product.**
   When equipment is serviced, first confirm that measures are in place to prevent dropping of work pieces and run-away of equipment, etc, and then cut the power supply to the system. When machinery is restarted, check that operation is normal with actuators in the proper positions.

[Lubrication]

⚠Caution

1. **The product has been lubricated for life at manufacturer, and does not require lubrication in service.**
   Contact SMC if lubrication will be applied.

14.6 Precautions for actuator with lock

⚠Warning

1. **Do not use the lock as a safety lock or a control that requires a locking force.**
   The lock used for the product with a lock is designed to prevent dropping of work piece.
2. **For vertical mounting, use the product with a lock.**
   If the product is not equipped with a lock, the product will move and drop the work piece when the power is removed.
3. **"Measures against drops" means preventing a work piece from dropping due to its weight when the product operation is stopped and the power supply is turned off.**
4. **Do not apply an impact load or strong vibration while the lock is activated.**
   If an external impact load or strong vibration is applied to the product, the lock will lose it's holding force and damage to the sliding part of the lock or reduced lifetime can result. The same situations will happen when the lock slips due to a force over the thurst of the product, as this accelerates the wear to the lock.
5. **Do not apply liquid or oil and grease to the lock or its surrounding.**
   When liquid or oil and grease is applied to the sliding part of the lock, its holding force will reduce significantly.
6. **Take measures against drops and check that safety is assured before mounting, adjustment and inspection of the product.**
   If the lock is released with the product mounted vertically, a work piece can drop due to its weight.
7. **When the actuator is operated manually (when servo is off), supply 24VDC to the [BK RLS] terminal of the power supply connector.**
   If the product is operated without releasing the lock, wearing of the lock sliding surface will be accelerated, causing reduction in the holding force and the life of the locking mechanism.
8. **Do not supply 24VDC power supply constantly to the [BK RLS(Lock release)] terminal.**
   Stop supplying 24VDC power supply to the [BK RLS(Lock release) terminal during normal operation. If power is supplied to the [BK RLS] terminal continuously, the lock will be released, and workpieces may be dropped at servo off.

15. Controller and its peripheral devices / Specific product precautions

15.1 Design and selection

⚠Warning

1. **Be sure to apply the specified voltage.**
   Otherwise, a malfunction and breakage of the controller may be caused.
   If the applied voltage is lower than the specified, it is possible that the load cannot be moved due to an internal voltage drop. Please check the operating voltage before use.
2. **Do not operate beyond the specifications.**
   It may cause a fire, malfunction or actuator damage can result. Please check the specifications before use.
3. **Install an emergency stop circuit.**
   Please install an emergency stop outside of the enclosure so that it can stop the system operation immediately and intercept the power supply.
4. **In order to prevent danger and damage due to the breakdown and the malfunction of this product, which may occur at a certain probability, a backup system should be established previously by giving a multiple-layered structure or a fail-safe design to the equipment, etc.**
5. **If a fire or danger against the personnel is expected due to an abnormal heat generation, ignition, smoking of the product, etc., cut off the power supply for this product and the system immediately.**

15.2 Handling

⚠Warning

1. **The inside of the controller and its connector should not be touched.**
   It may cause an electric shock or damage to the controller.
2. **Do not perform the operation or setting of this equipment with wet hands.**
   It may cause an electric shock.
3. **Product with damage or the one lacking of any components should not be used.**
   It may cause an electric shock, fire, or injury.
4. **Use only the specified combination between the controller and electric actuator.**
   It may cause damage to the controller or the actuator.
5. **Be careful not to be caught or hit by the workpiece while the actuator is moving.**
   It may cause an injury.
6. **Do not connect the power supply or power on the product before confirming the area where the work moves is safe.**
   The movement of the work may cause accident.
7. **Do not touch the product when it is energized and for some time after power has been disconnected, as it is very hot.**
   It may lead to a burn due to the high temperature.
8. **Check the voltage using a tester for more than 5 minute after power-off in case of installation, wiring and maintenance.**
   There is a possibility of getting electric shock, fire and injury.
9. **Do not use in an area where dust, powder dust, water or oil is in the air.**
   It will cause failure or malfunction.
10. **Do not use in an area where a magnetic field is generated.**
    It will cause failure or malfunction.
11. **Do not install in the environment of flammable gas, corrosive gas and explosive gas.**
    It could lead to fire, explosion and corrosion.
12. **Radiant heat from strong heat supplys such as a furnace, direct sunlight, etc. should not be**

applied to the product.
It will cause failure of the controller or its peripheral devices.

13. Do not use the product in an environment subject to a temperature cycle.
It will cause failure of the controller or its peripheral devices.

14. Do not use in a place where surges are generated.
When there are units that generate a large amount of surge around the product (e.g., solenoid type lifters, high frequency induction furnaces, motors, etc.), this may cause deterioration or damage to the product's' internal circuit. Avoid supplys of surge generation and crossed lines.

15. Do not install this product in an environment under the effect of vibrations and impacts.
It will cause failure or malfunction.

16. If this product is used with a relay or solenoid valve, they should be the surge absorbing element built-in type.

15.3 Installation

⚠Warning

1. **The controller and its peripheral devices should be installed on a fire-proof material.**
A direct installation on or near a flammable material may cause fire.
2. **Do not install this product in a place subject to vibrations and impacts.**
It may cause an electric shock, fire, or injury.
3. **Take measure so that the operating temperature of this controller and its peripheral devices are within the range of the specifications. Also, this controller should be installed with 50mm or larger spaces between each side of it and the other structures or components.**
It may cause a malfunction of the controller and its peripheral devices and a fire.
4. **Do not mount this controller and its peripheral devices together with a large-sized electromagnetic contactor or no-fuse breaker, which generates vibration, on the same panel. Mount them on different panels, or keep the controller and its peripheral devices away from such a vibration supply.**
5. **This controller and its peripheral devices should be installed on a flat surface.**
If the mounting surface is distorted or not flat, an unacceptable force may be added to the housing, etc. to cause troubles.

15.4 Wiring of cables/Common precautions

⚠Warning

1. **Do not apply any excessive force to cables by repeated bending, tensioning or placing a heavy object on the cables.**
It may cause an electric shock, fire, or breaking of wire.
2. **Connect wires and cables correctly.**
Incorrect wiring could break he controller or its peripheral devices depending on the seriousness.
3. **Do not connect wires while the power is supplied.**
It can break the controller or its peripheral devices could be damaged to cause a malfunction.
4. **Do not carry this product by holding its cables.**
It may cause an injury or damage to the product.
5. **Do not connect power cable or high-voltage cable in the same wiring route as the unit.**
Te wires to the controller or its peripheral devices can be interrupted with noise or induced surge voltage from power lines or high-voltage lines and malfunction could be caused.
Separate the wiring of the controller and its peripheral device from that of power line and high voltage line.
6. **Verify the insulation of wiring.**
Insulation failure (interference with other circuit, poor insulation between terminals and etc.) could introduce excessive voltage or current to the controller or its peripheral devices and damage them.

15.5 Power supply

⚠Caution

1. **Use a power supply that has low noise between lines and between power and ground.**
   In cases where noise is high, an isolation transformer should be used.
2. **The power supplys should be separated between the controller power and the I/O signal power and both of them do not use the power supply of "rush-current restraining type".**
   If the power supply is "rush-current restraining type", a voltage drop may be caused during the acceleration of the actuator.
3. **To prevent surges from lightning, an appropriate measure should be taken. Ground the surge absorber for lightning separately from the grounding of the controller and its peripheral devices.**

15.6 Grounding

⚠Warning

1. **Be sure to carry out grounding in order to ensure the noise tolerance of the controller.**
   It may cause an electric shock or fire.
2. **Dedicated grounding should be used.**
   Grounding should be to a D-class ground (Ground resistance of 100 Ω or less.)
3. **Grounding should be performed near the unit as much as possible to shorten the grounding distance.**
4. **In the unlikely event that malfunction is caused by the ground, it may be disconnected.**

15.7 Maintenace

⚠Warning

1. **Perform a maintenance check periodically**
   Confirm wiring and screws are not loose.
   Loose screws or wires may cause unintentional malfunction.
2. **Conduct an appropriate functional inspection after completing the maintenance.**
   In case of any abnormities (in the case that the actuator does no move, etc.), stop the operation of the system. Otherwise, an unexpected malfunction may occur and it will become impossible to secure the safety.
3. **Do not disassemble, modify or repair this controller and the peripheral equipment.**
4. **Do not put anything conductive or flammable inside of this controller.**
   It may cause a fire and explosion.
5. **Do not conduct an insulation resistance test and withstand voltage test on this product.**
6. **Ensure sufficient space for maintenance activities. Provide space required for maintenance.**
   Design the system that allows required space for maintenance.

16. Troubleshooting

Refer to the table below for troubleshooting. When none of the causes in the troubleshooting can be confirmed and normal operation is recovered by the replacement of a part, it is presumed that failure is in the product.
Problems with the product may be due to the operating environment (application). Please consult us if troubleshooting is necessary.

16.1 Operation troubles

Failure Problem	Possible causes	Investigation method and the location of possible causes	Countermeasure
Does not operate	Power supply failure	Controller LED(Green) lights up?	Check the supplied voltage and current for power supply to the controller. --><u>**4. External connection (P.15)**</u>
	External equipment failure	PLC connected to the controller operates properly? Check the operation with a test run of the controller alone.	Refer to the operation manual of the controller. --> <u>**6. CN4: Parallel I/O cable (P.19)**</u>
	Wiring failure	Check if the wiring is correct. Refer to the operation manual of the controller to check wiring, for broken wires and short-circuits. Correct wiring and check if the input/output of each signal is correct.	Prepare separate power supply for CN1 controller input power supply and CN4 input / output signal power supply. --><u>**4. External connection (P.15)**</u> --><u>**6.4 Parallel I/O connector wiring (Example) (P.22)**</u>
	Alarm generated	Controller alarm is generated? Refer to the operation manual of the controller. Check the type of alarm.	Refer to the operation manual of the controller. --><u>**12. Alarm detection (P.61)**</u>
	Unlocking error	When the unlock switch is turned ON or OFF there is an unlocking sound made.	If there is no unlocking sound from the actuator, a locking failure is possible. -> If the problem continues to happen, please contact SMC us.
	Unsuitable specification	Check if a product with a suitable specification was selected. Reconfirm the combination of the power supply and the controller and the actuator in used is correct.	Confirm if the combination of the actuator part number which is applicable for the controller and used actuator is correct. --> <u>**2.2 How to Order (P.6)**</u>

Failure Problem	Possible causes	Investigation method and the location of possible causes	Countermeasure
Operation stops intermittently	Alarm generated	Controller alarm is generated? Check the type of the alarm referring to the operation manual of the controller for troubleshooting.	Refer to the operation manual of the controller. --><u>**12. Alarm detection (P.61)**</u>
	Wiring failure	Check if the wiring is correct. Refer to the operation manual of the controller to check wiring, for broken wires and short-circuits.	Correct wiring and check if the input/output of each signal is correct. Prepare a separate power supply for the CN1 controller input power supply and CN4 input / output signal power supply. --><u>**4. External connection (P.15)**</u> --><u>**6.4 Parallel I/O connector wiring (Example) (P.22)**</u>
	Counter-measures against noise	Ground properly. Avoid bundling the cables.	Refer to the operation manual of the controller. --> <u>**3.4 Mounting (P.13)**</u>
	Voltage drop	Temporary voltage drop in the power supply.	Possibility of momentary voltage drop due to an inadequate power supply capacity, or the power supply is inrush current suppressor type. --><u>**3.1 Basic specifications (P.10)**</u>
	Pushing operation failure	Tries to perform pushing in manual mode?	Pushing operation is not available in manual mode except for testing. Switch to test function or perform pushing in auto mode. --><u>**(C) Manual mode after retuning to origin position (P.37)**</u>
	Unsuitable specification	Check if a product with a suitable specification was selected. Reconfirm the combination of the power supply and the actuator and controller.	Confirm if the combination of the actuator part number which is applicable for the controller and the actuator in use is correct. --> <u>**2.2 How to Order (P.6)**</u>

16.2 Position / Speed troubles

Failure Problem	Possible causes	Investigation method and the location of possible causes	Countermeasure
Displa-cement	Displaced from the origin	In case of return to origin with pushing operation, does the actuator travel to the origin? Perform return to origin several times to check the origin position.	Check if foreign matter is caught in the product by operating the actuator.
	Unsuitable specification	Check if a product with a suitable specification was selected. Reconfirm the combination of the power supply and the actuator and controller.	Confirm if the combination of the actuator part number which is applicable for the controller and used actuator in use is correct. --> **2.2 How to Order (P.6)**
Doesn't move to the correct position	Wiring failure	Check if the wiring is correct. Refer to the operation manual of the controller to check wiring, for broken wires and short-circuits.	Correct wiring and check if the input/output of each signal is correct. Prepare a separate power supply for the CN1 controller input power supply and CN4 input / output signal power supply. -->**4. External connection (P.15)** -->**6.4 Parallel I/O connector wiring (Example) (P.22)**
	Unsuitable specification	Check if a product with a suitable specification was selected. Reconfirm the combination of the power supply and the actuator and controller.	Confirm if the combination of the actuator part number which is applicable for the controller and used actuator in use is correct. --> **2.2 How to Order (P.6)**
Speed does not reach the desired speed	Operation pattern is not suitable	Operation pattern is triangular? If the operation pattern is triangular, it is possible that the actuator will start to decelerate before reaching the maximum speed.	Lengthen the travel distance, or set a larger acceleration value. -->**7.1 Setting procedure (P.24)**
	Speed change in auto mode	Change the value of the speed or acceleration switch in auto mode.	Go to speed adjustment in auto mode to change the speed and acceleration. -->**(B) Auto mode after return to origin position (P.36)**
	Unsuitable specification	Check if a product with a suitable specification was selected. Reconfirm the combination of the power supply and the actuator and controller.	Confirm if the combination of the actuator part number which is applicable for the controller and used actuator in use is correct. --> **2.2 How to Order (P.6)**

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